IDEA: THE JOURNAL OF LAW AND TECHNOLOGY

VOLUME 22

1981-1982

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The publication rate is: four issues per year published with the cooperation of the Academy of Applied Science.

All members of the PTC will receive one complimentary subscription (all issues published) as long as their membership continues.

The price of issues purchased separately is $7.50 per copy.

The subscription rate is $25.00 per year. Foreign Subscriptions are $30.00.

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IDEA
The PTC Research Foundation
2 White Street
Concord, N.H. 03301

IDEA: The Journal of Law and Technology is indexed in Contents of Current Legal Periodicals.

Printed by Capital Offset Company, Inc., Concord, New Hampshire 03301.

Back copies available directly from William S. Hein & Company, Inc., 1285 Main Street, Buffalo, New York 14209.

COMMENTARY

DOJ Brings Action under 35 U.S.C. §135(c)
United States of America v. FMC Corporation
C.A. 80-1570
(D.C. E.D. Pa.)

The government of the United States, through the Department of Justice, recently brought suit against the FMC Corporation, contending that FMC failed to file copies of all patent interference settlement agreements with the Patent and Trademark Office as required by 35 U.S.C. §135(c). The initiation of a suit under this section of the Patent Act is unprecedented, and FMC has responded with a motion to dismiss for failure to state a claim upon which relief can be granted.[1] Prosecution of this type is unique because §135(c) has previously been used only as a defense, never to create a cause of action.

The section in question reads as follows:

> (c) Any agreement or understanding between parties to an interference, including any collateral agreements referred to therein, made in connection with or in contemplation of the termination of the interference, shall be in writing and a true copy thereof filed in the Patent and Trademark Office before the termination of the interference as between the said parties to the agreement or understanding. If any party filing the same so requests, the copy shall be kept separate from the file of the interference, and made available only to Government agencies on written request, or to any person on a showing of good cause. Failure to file the copy of such agreement or understanding shall render permanently unenforceable such agreement of understanding and any patent of such parties involved in the interference or any patent subsequently issued on any application of such parties so involved....

Although this provision does not expressly authorize or preclude a suit of this type, there are a variety of factors, relevant to 35 U.S.C. §135(c) in particular, and the Patent Act as a whole, which FMC has brought to light in a memorandum in support of its motion, and which bear examination with respect to the cause of action.

It is a unique feature of the Patent Act that any one of its provisions which creates a cause of action will specifically designate in whom that right of action is vested.[2] 35 U.S.C. §135(c) does not have such desig-

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[1] Federal Rule of Civil Procedure 12(b) (6).

[2] 35 U.S.C. §145 "An applicant dissatisfied with the decision of the Board of Appeals may... have remedy by civil action...."

nation. Of precedential note is the fact that in the eighteen years since enactment of §135(c), it has never been used in the manner contemplated by the government in *FMC*. Neither the government nor a private party has ever initiated an action under 35 U.S.C. §135(c). The statute has always been used as a defense in infringement suits in the same manner as the equitable doctrines of misuse or "unclean hands."

In relation to the misuse defense is the actual sanction that the statute

> ... shall render permanently unenforceable such agreement or understanding and any patent of such parties involved in the interference ....

As is pointed out in FMC's memorandum, unenforceability is a recognized concept in patent law and has evolved from misuse cases. Misuse is an equitable defense that may be raised by any party against whom a patent is asserted. If misuse is found, the patent is then held unenforceable. In essence, 35 U.S.C. §135(c) creates another category of misuse, the nonfiling of patent interference settlement agreements, to which the usual sanction of unenforceability is applied.

The government, in its response to the motion to dismiss, has placed primary reliance on analogy to a 1967 Supreme Court case, *Wyandotte v. United States*.[3] This case was brought under §15 of the Rivers and Harbors Act of 1899. It dealt with whether the government could obtain in personam jurisdiction over owners of negligently sunken barges, and whether civil action could be taken against the barge owners, even though the statute authorized only criminal liability. The Supreme Court, in holding for the government on both points,

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35 U.S.C. §146 "Any party to an interference dissatisfied with the decision of the board of patent interferences... may have remedy by civil action...."

35 U.S.C. §281 "A patentee shall have remedy by civil action for infringement...."

35 U.S.C. §288 "Whenever, without deceptive intention, a claim of a patent is invalid, an action may be maintained for the infringement of a claim of the patent which may be valid."

35 U.S.C. §289 "Whoever during the term of a patent for a design, without license of the owner uses the patented design for the purpose of sale... shall be liable to the owner to the extent of his total profit... recoverable in any United States district court having jurisdiction of the parties."

35 U.S.C. §291 "The owner of an interfering patent may have relief against the owner of another by civil action...."

35 U.S.C. §1498 "Whenever an invention described in and covered by a patent... is used or manufactured by or for the United States without license... the owner's remedy shall be by court action against the United States in the Court of Claims...."

[3] 389 U.S. 191 (1967).

found that the government was the principal beneficiary of the Act. The Department of Justice has interpreted this to hold that anytime the United States government is a principal beneficiary of a law, it then has a right of action under such law.

However, the Supreme Court, in the *Wyandotte* decision, also discussed the fact that navigable waters of the United States are public property of the nation. When the Court held that the government had a right of action, it was because it could sue to protect its interests.[4] All the cases cited in this portion of *Wyandotte* dealt with subject matter in which the United States actually has a *property* interest.[5] This portion of the opinion indicates that for the United States to have a right of action it must at least have a *property* interest in the subject matter in dispute, and may, in addition, need to be the principal beneficiary of the law.

In *FMC,* the government has no property interest whatsoever in the patent or the settlement agreements. In order for the government to have a right of action under the *Wyandotte* standard, it must have some property interest that has been damaged. The government in *FMC* has no damaged property interest to confer standing.

Both parties to the action have cited legislative history of 35 U.S.C. §135(c) in support of their respective positions. Although legislative history may oftentimes be ambiguously interpreted, perhaps the most telling portion of that history is a statement by then Commissioner of Patents and Trademarks, David Ladd:

> ... the bill is an effort to strike a balance in consideration on the one hand of the customary confidentiality in which a businessman carries on his business in relationship to his competitors, and on the other hand, the desirability of allowing Government agencies which are concerned with policing violations of antitrust laws, with access to the information.

If FMC's motion to dismiss is denied and the Department of Justice is allowed to prosecute under this new cause of action, then the balance desired will be lost. The government will not only be allowed to interfere directly in domestic business agreements, but the possibility for its interfering in international agreements involving foreign law[6] will also be available. Either possibility raises a variety of policy questions

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[4] 389 U.S. 191 at page 201 (1967).

[5] *Cotton v. United States,* 11 Howard 229 (1851)-public land.
United States v. San Jacinto Tin Co., 125 U.S. 273 (1888)-public land.
Sanitary District v. United States, 266 U.S. 405 (1925)-navigable waters.

[6] For example, in the complaint the Government alleged failure to file "an agreement entitled 'Canadian Conflict Settlement Agreement' dated September 10, 1968 which concerns settlement of the Canadian ... patent interference ...."

as to how involved government should be permitted to become in business transactions.

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Data Cash Systems, Inc. v. JS&A Group, Inc.
No. 80-1085, U.S.C.A., 7th Circuit, Sept. 2, 1980
Slip Opinion

The plaintiff, Data Cash Systems, employed a consultant to design and develop a computer program for an electronic, computerized game to be called "Compuchess". The development program included the installation of the final program in a "Read-Only-Memory" (ROM) computer chip which was then to be manufactured and installed in the circuitry of the game.

The development of the chip and the game were completed in April, 1977, and "Compuchess" was marketed, including the distribution to the public of over 2,500 copies, in the Fall of that year. Although a copyright notice appeared on the source program (software), there was no notice either on the chip or anywhere on the game itself. After problems developed, the source program was registered and a certificate of copyright issued.

In late 1978, defendants, JS&A Group, began marketing a competing computer chess game called, "Chess, One Move Calculation" which used a ROM identical to that of "Compuchess". After other attempts to stop JS&A from distributing its game, Data Cash brought suit in the United States District Court for the Northern District of Illinois, Eastern Division[1], for copyright infringement and unfair competition.

The District Court, after hearing the plaintiff's argument which mainly defended its rights against forfeiture of copyright, denied the plaintiff a preliminary injunction against further distribution and granted the defendants summary judgment on the plaintiff's claim of copyright infringement. The adjudication of the second count, that of unfair competition, was suspended pending the appeal by plaintiff of the court's decision on the first count.[2] In making its decision, the district court held that the ROM was not a "copy" as contemplated by the copyright law and therefore its reproduction did not constitute an infringement.

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[1] 480 F. Supp. 1063, 203 U.S.P.Q. 135. (1978).

[2] 28 U.S.C. 1292(A)(1).

The court of appeals affirmed the district court decision. However, the court of appeals held that the matter of forfeiture was dispositive of the case since there had been no proper notice and there had been a public distribution of the product. In holding that forfeiture was the basis for its decision, the appeals court could not have ignored the matter of whether or not the ROM was a copy. Indeed, forfeiture could only have been found to have occurred by the improper publication of a "copy". Thus, the court of appeals, in its holding, clearly reversed the district court and found the ROM to be a "copy" of the source program. The court of appeals did not comment on the decision below, however, nor did either party argue for its reasoning.

After determining that, because of forfeiture, the ROM was in the public domain, the court addressed the question of whether the 1909 or the 1976 Copyright Act was the applicable law. The plaintiff (appellant in the court of appeals) argued that the 1976 Act applied because the act of infringement took place after the effective date. The court disagreed since public distribution took place before the effective date and the forfeiture of copyright occurred upon that publication without proper notice.[3]

The plaintiff also argued that publication had been "limited" due to restrictions which are to be implied by the nature of "Compuchess". The court quickly disposed of this argument, citing the definition of a "limited" publication as stated in *White v. Kimmell.*[4]

The plaintiff then asserted that, since it was led to believe that the ROM program could not be deciphered without a printout, the publication without notice was a "mistake". The court held that this kind of "mistake" had not been contemplated by the legislature in that section[5] of the Copyright Act of 1909; and that the burden of proper notice still remained with the plaintiff. Thus the court of appeals found entirely different grounds for its decision than the district court.

The decision of the court of appeals in this case should be of considerable concern to attorneys and judges considering copyright claims involving "new technology". How did the court come to the conclusion that the ROM was a "copy" subject to the forfeiture provisions of the Copyright Act of 1909?

The 1909 Act was not clear concerning what was and was not a "copy". That definition was supplied, however, before the effective date of the Act in the seminal case, *White-Smith Music Pub. Co. v. Appollo*

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[3] 17 U.S.C. Chapter I, 10 (1909).

[4] 193 F. 2d 744, 92 U.S.P.Q. 400 (9th Cir. 1952).

[5] 17 U.S.C. Chapter I, 21 (1909).

Co.[6], in which the court held a copy to be "a written or printed record of (a musical composition) in intelligible notation".[7] In 1972, a specific exception was made to that definition in an amendment to the Copyright Act making sound recordings (phonorecords) copyright subject matter.[8] No other exception was made under the 1909 Act. Therefore, the ROM, a non-written, unintelligible record and not a "phonorecord" could not be considered subject matter of copyright and was consequently not a "copy".

Assuming that there is a proper argument that this case might be decided under the 1976 Copyright Act[9] (no such argument was made), we now consider the effect of that Act on the decision. The 1976 Act significantly broadened the definition of copyright subject matter through a greater specificity as to the interpretation of the term "writings" as used in the U.S. Constitution.[10] However, the Act specifically denies protection to works used in "conjunction with automatic systems..."[11], relegating such works to have only those rights under the laws in effect prior to January 1, 1978. Thus, if the applicable law was the 1976 Copyright Act, the plaintiff would still be denied protection as described under the 1909 Act.

Judge Flaum of the United States District Court reached the only available decision based on a logical interpretation of the copyright laws. On the other hand, the 7th Circuit Court of Appeals, in not explaining how it determined that the ROM was proper subject matter of copyright, subject to forfeiture, merely muddied the already churning waters of the rights of intellectual property owners.

Our final question is whether or not Data Cash Systems still has a source of relief in the second count of its claim under the state law of unfair competition. The decision of the court of appeals, which sets forth the law of the case, would appear to answer, no. Using the rationale of the court of appeals, it can be shown as in the *Sears-Compco*[12] cases that, since Congress did contemplate this subject matter in the copyright law, all rights were preempted by the federal

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[6] 209 U.S. 1; 28 S. Ct. 319 (1908).

[7] id. at 17.

[8] Public Law 92-139, 85 Stat. 391, Act of October 15, 1971, Effective, February 15, 1972.

[9] 17 U.S.C. Chapter 1, 102 (1976).

[10] U.S. Const. Art I, 8, Clause 8.

[11] 17 U.S.C. Chapter 1, 117 (1976).

[12] *Sears Roebuck & Co. v. Stiffel Co.* 376 U.S. 225, 140 U.S.P.Q. 524 (1964) *Compco Corp. v. Day Brite Lighting Co.,* 376 U.S. 234, 140 U.S.P.Q. 528 (1964).

copyright act, extinguishing other claims. If, however, the district court theory of the case is followed, an argument based on that of *Goldstein v. California*[13] should be made which would state that since Congress had not chosen to occupy the field of this product, state laws of misappropriation and unfair competition apply.

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Author's Note in Press:

H.R. 6933, a comprehensive patent reform bill, was signed into law by President Carter on December 12. It includes an amendment to 17 U.S.C. 117 which appears to have broadened the scope of copyright to include works used in conjunction with computers. The amendment appears at first reading to have given proper authority to the holding of the appeals court thereby.

New Matter: 35 U.S.C. 132

The opinion (*Eli Lilly and Company v. Premo Pharmaceutical Laboratories, Inc., et al.,* 207 U.S.P.Q. 719) of the Court of Appeals, Third Circuit, constitutes a giant step forward in the interpretation of "new matter" precluded by 35 USC 132. The pertinent issues presented on appeal are succinctly stated: First, Premo argued that the district court erred in holding that, although structurally obvious in light of prior art, cephalexin was nevertheless patentable because it yielded the unanticipated and non-obvious characteristic of one hundred percent absorbability into the blood stream. Second, it urged that, even if the district court did not so err, Eli Lilly's patent is invalid because the company did not adequately disclose the absorbability trait in either the patent or in the patent application. Third, it claimed the patent is invalid because Eli Lilly disclosed the trait in an amendment to the original Abstract of Disclosure in violation of the statutory prohibition against introducing new matter by amendment. Fourth, it maintained that the patent is invalid because the unexpected property in fact was discovered by someone other than the persons listed in the patent application as the inventors.

The Court recognized that the determination whether a new drug is non-obvious should be based on a consideration of the properties exhibited by the drug as well as the chemical structure of the drug. Reliance was placed on *In re Papesch,* 137 U.S.P.Q. 43 (C.C.P.A.

[13] 412 U.S. 546, 178 U.S.P.Q. 129 (1973).

1963), for the proposition that "[t]here is no basis in law for ignoring any property in making such a comparison". The district court correctly considered all properties of the claimed compound in assessing its obviousness. According to the Court, anything short of full patent protection for structurally obvious, but biologically non-obvious, new drugs that meet the other statutory criteria "would discourage both the inspiration-perspiration process of the laboratory and the incentive to publicly disclose products of value to mankind."

The real advancement over prior art — cephalexin's one hundred percent absorption rate — was totally unexpected, even by the chemists who proposed its synthesis. No reference, however, was made in the application (which matured into the patent in issue) to such absorption rates, and the issue was raised as to whether a non-disclosed property could be relied upon as a basis for establishing patentability. In an abstract to the patent on cephalexin, which was added by amendment to the application prior to the issuance of the patent, Eli Lilly specified that cephalexin is "especially of interest for its use as an antibiotic when administered by the oral route." Although the application did not expressly identify the non-obvious trait — the one hundred percent rate of absorption — the information Eli Lilly did supply was such that the nature of the trait could readily be identified by a person skilled in the prior art. Under these circumstances, the non-obvious trait may be said "to flow inherently" from the properties and data supplied in the application and accompanying documents.

The Court stated that the 1968 amendment did not disclose an invention, process, or apparatus that was not described in the 1962 application. Rather, the 1968 amendment "completed" the prior disclosure by identifying and "clarifying" some of the properties of cephalexin, as well as its salutary performance as an oral antibiotic. Inasmuch as a chemical compound and its properties "are one and the same thing", newly discovered properties of the compound not disclosed in the original specification or abstract may be added by amendment without being treated as "new matter" under §132.

The nature of "new matter" is considered in some detail in the opinion of the Court of Customs and Patent Appeals for *In re Oda, Fujii, Moriga, and Higaki,* 170 U.S.P.Q. 268, 270, 271 (C.C.P.A. 1971), which points out that "new matter" is a technical term in patent law — a term of art; its meaning has never been clearly defined for it cannot be.

The holding in the *Eli Lilly* case is in complete accord with the established practice of permitting an applicant to refile an application

claiming new chemical compounds and to rely on the filing date of his parent application even though he inserts in the refiled application properties (not disclosed in the parent application) upon which patentability is predicated. The subject opinion of the Court of Appeals, Third Circuit, condones the additional step of authorizing an applicant to amend his disclosure to include such properties without having to refile his application and incur the expense and loss of time that necessarily accompanies such refiling.

A discussion of the need to disclose a property relied upon to distinguish over prior art is presented in the opinion for *In re Davies and Hopkins,* 177 U.S.P.Q. 381, 384, 385 (C.C.P.A. 1973), wherein the Court pointed out that evidence of undisclosed advantages that "would inherently flow" from what was disclosed in the specification was accepted in Zenitz [*In re Zenitz,* 142 U.S.P.Q. 158 (C.C.P.A. 1964)] and in Khelghatian [*In re Khelghatian,* 150 U.S.P.Q. 661 (C.C.P.A. 1966)] but that a basic property or utility must be disclosed in order for affidavit evidence of unexpected properties to be offered; reference was made to *In re Lorenz,* 142 U.S.P.Q. 101 (C.C.P.A. 1964) in support of the latter proposition.

In addition to the facts that the very property — the one hundred percent rate of absorption — relied upon was not present in the disclosure and that which was introduced by amendment was merely the advantageous use of the antibiotic when administered by the oral route, the opinion for the *Eli Lilly* case further considers an issue of inventorship. As the one hundred percent absorption rate relied upon for patentability was actually discovered by a biochemist who was not one of the named inventors, Premo argued that the true inventive entity was not properly reflected by the named inventors. The Court decided that the fact that a person other than the named inventors *discovered* the non-obvious trait possessed by cephalexin does not make that person an *inventor* of cephalexin for purposes of §116. It was beyond question that the named inventors were the only persons who performed the synthesis that created the patented product. In the words of §116, cephalexin was "made by" the two named inventors, not by the biochemist who first noted that the organic chemists' predictions had been realized. This holding appears to confirm a view expressed in "It's Time to Quit Playing Inventorship Roulette", *Journal of the Patent Office Society,* Vol. 56, No. 7, page 472, July 1974.

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THE SYNERGISTIC RESULT AND SECTION 103: TOWARD REJECTION OF A RHETORICAL EMBELLISHMENT**

JOSEPH E. ROOT III*

I. INTRODUCTION

The Supreme Court of the United States has held itself out as the ultimate arbiter of the level of patentable invention for over a century. Wielding the judge-made rule of "invention," the Court has struck down patents that admittedly met the criteria of novelty and utility, but which the Court felt did not represent sufficiently substantial steps above the prior art. Codification of the standard of invention in the Patent Act of 1952 seemed to promise a relatively objective measure of inventiveness, but dicta from recent Supreme Court decisions indicate that subjective evaluation has returned, under the guise of a requirement that a combination of "old" elements demonstrate a "synergistic result."

Lower courts have applied the synergism test enthusiastically and, until 1979, uncritically. The Seventh Circuit called a halt to this unquestioning adoption of dictum in *Republic Industries, Inc. v. Schlage Lock Co.*[1] A thoughtful analysis of the basis and efficacy of the synergism requirement revealed that the test did not comport with the statutory measure of inventiveness, section 103.[2] Since then, five other circuits have reconsidered the need for a synergistic result, and a trend toward rejection of the rule has been established.

The synergism requirement cannot withstand careful analysis. Exploration of the rule's development, substantive basis, and application demonstrate that synergism is inherently incapable of serving as a

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**The article has been selected as the winner of the American Patent Law Association's Robert C. Watson Award for 1981.

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[1] 592 F.2d 963, 200 U.S.P.Q. 769 (7th Cir. 1979).

[2] 35 U.S.C. §103 (1976).

tool to measure patentability. The time has come to recognize synergism, like the "flesh of genius" test before it, as a rhetorical embellishment masquerading as a rule of law.[3]

II. HISTORICAL DEVELOPMENT — FROM INVENTION TO SYNERGISM

A. The invention standard and combination patents

Prior to the Patent Act of 1952,[4] the Supreme Court had wrestled with the concept of "invention" for a century. Stripped to bare bones, "invention" is the idea that patentable devices not only must meet the technical requirements of novelty and utility,[5] but also they must represent a substantial step above the prior art. That idea seems reasonable enough at first glance, but articulation of exactly how one differentiates invention from mere improvement presented an impossible task. The Court's first effort was in *Hotchkiss v. Greenwood,*[6] 1850; the Court invalidated a patent because the device did not require "more ingenuity and skill in applying the old method... than were possessed by an ordinary mechanic acquainted with the business...."[7] Subsequently, the Court essayed numerous definitions of "invention,"[8] but perhaps the most accurate — as well as the most candid — description of the Court's standard was "that impalpable something which distinguishes invention from simple mechanical skill."[9] For all its effort, however, the Court never succeeded in for-

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[3] The "flash of genius" test was coined by Mr. Justice Douglas in *Cuno Engrg. Corp. v. Automatic Devices Corp.,* 314 U.S. 84, 90, 51 U.S.P.Q. 272, 275 (1941). For some time thereafter, lower courts and commentators struggled with the so-called test. *See* Schneider, *Non-obviousness, the Supreme Court, and the Prospects for Stability,* 60 J. PAT. OFF. SOC'Y 304, 316 (1978). *See also* notes 16 and 27 *infra* and accompanying text. Notwithstanding all the problems it had caused, the Supreme Court later explained the "flash of genius" language as "but a rhetorical embellishment." *Graham v. John Deere Co.,* 383 U.S. 1, 15 n.7, 148 U.S.P.Q. 459, 466 n.7 (1966).

[4] Patent Act of 1952, PUB. L. NO. 82-593, 66 Stat. 792 (1952).

[5] *See* 35 U.S.C. §§101, 102 (1976).

[6] 52 U.S. (11 How.) 248 (1850).

[7] *Id.* at 267. The patent covered knobs manufactured from clay and porcelain, instead of wood, metal, or bone, as taught by the prior art. *Id.* at 264.

[8] *See* A. DELLER, 2 DELLER'S WALKER ON PATENTS §102 *passim* (2d ed. 1964) (discussing cases) [hereinafter cited as DELLER'S WALKER].

[9] *McClain v. Ortmayer,* 141 U.S. 419, 427 (1891).

The court said,

> The truth is the word cannot be defined in such manner as to afford any substantial aid in determining whether a particular device involves an exercise of the inventive faculty or not. In a given case we

mulating a workable, understandable definition.[10]

The problem of invention presented itself most vexatiously in what the Court has termed combination patents. The devices covered by the claims of such patents are said to consist of either a new arrangement of old components or an old arrangement with one or more new components. The Court refused to find invention in what it termed a "mere aggregation" of old elements.[11] After a general drift toward strict scrutiny of combinations,[12] the Court erected a high barrier in *Lincoln Engineering Co. v. Stewart Warner Corp.*[13] in 1938. The rule formulated there precluded patentability for an arrangement of old parts in which the elements perform no new function or

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> may be able to say that there is present invention of a very high order. In another we see that there is lacking that impalpable something which distinguishes invention from simple mechanical skill. Courts, adopting fixed principles as a guide, have by a process of exclusion determined that certain variations in old devices do or do not involve invention; but whether the variation relied upon in a particular case is anything more than ordinary mechanical skill is a question which cannot be answered by applying the test of any general definition.

Id.

[10] *Great Atlantic & Pacific Tea Co. v. Supermarket Equip. Co.*, 340 U.S. 147, 151, 87 U.S.P.Q. 303, 305 (1950) (Jackson, J.) ("the concept of invention is inherently elusive when applied to a combination of old elements").

[11] > While this Court has sustained combination patents, it never has ventured to give a precise and comprehensive definition of the test to be applied in such cases. The voluminous literature which the subject has excited discloses no such test. It is agreed that the key to patentability of a mechanical device that brings old factors into cooperation is presence or lack of invention. In course of time the profession came to employ the term 'combination' to imply its presence and the term 'aggregation' to signify its absence, thus making antonyms in legal art of words which in ordinary speech are more nearly synonyms

Id. at 150-51, 87 U.S.P.Q. at 305 (footnotes omitted).

An example of the difficulty the Court encountered in analyzing combinations is presented in the discussion of "mere improvements" versus "pioneer patents" in *Bassick Mfg. Co. v. R.M. Hollingshead Co.*, 298 U.S. 415, 29 U.S.P.Q. 311 (1935). *See also* 2 DELLER'S WALKER, *supra* note 8, §110.

[12] Mintz, *The Standard of Patentability in the United States – Another View*, 1977 DET. C.L. REV. 755, 775. Tracing the history of the invention standard, the author notes that during the period leading up to and including the Depression, "[t]he Supreme Court itself assumed a general posture which evidenced a more negative and subjective attitude." *Id. But see* note 74 *infra*.

[13] 303 U.S. 545, 37 U.S.P.Q. 1 (1938).

operation different from that previously performed.[14] In addition, an improvement of one part of the combination does not allow a patent on the entire device.[15]

Lincoln Engineering triggered an assault on combination patents. Three years later, Mr. Justice Douglas, writing for the Court in *Cuno Engineering Corp. v. Automatic Devices Corp.*, asserted that a combination must "reveal the flash of genius" in its inception.[16] That decision led to *Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Co.*, in 1950.[17] Mr. Justice Jackson articulated an even tighter rule: "The conjunction or concert of known elements must contribute something; only when the whole in some way exceeds the sum of its parts is the accumulation of old devices patentable."[18] Concurring, Mr. Justice Douglas went beyond *Cuno Engineering;* to be patentable, he said, a device "has to be of such quality and distinction that masters of the scientific field in which it falls will recognize it as an advance."[19] Given such sweeping language, a court could invalidate patents practically at will.[20]

B. Section 103 of the Patent Act of 1952.

The years following World War II saw congressional consideration of a number of proposals to codify the standard of patentability. President Roosevelt's National Patent Planning Commission had recommended enactment of an objective standard in 1943,[21] and between 1948 and 1952, several bills were introduced.[22] Various formulations were proposed, evaluated, and rejected before Congress settled on

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[14] *Id.* at 549, 37 U.S.P.Q. at 3.

[15] *Id.* This formulation is the basic rule for combination patents. *See* 2 DELLER'S WALKER, *supra* note 8, §110.

[16] 314 U.S. 84, 90, 51 U.S.P.Q. 272, 275 (1941). *See also* note 80 *infra.*

[17] 340 U.S. 147, 87 U.S.P.Q. 303 (1950).

[18] *Id.* at 152, 87 U.S.P.Q. at 305.

[19] *Id.* at 154, 87 U.S.P.Q. at 307 (Douglas, J., concurring, joined by Black, J.).

[20] *See Jungerson v. Ostby & Barton Co.*, 335 U.S. 560, 572, 80 U.S.P.Q. 32, 36 (1949) (Jackson, J., dissenting) ("the only patent that is valid is one which this Court has not been able to get its hands on").

[21] REPORT OF THE NATIONAL PATENT PLANNING COMMISSION, H.R. DOC. NO. 239, 78th Cong., 1st Sess. 6 (1943). The Commission had found that "[o]ne of the greatest technical weaknesses of the patent system is the lack of a definitive yardstick as to what is invention." *Id.* at 10.

[22] *See* V. EDWARDS, EFFORTS TO ESTABLISH A STATUTORY STANDARD OF INVENTION, STUDY NO. 7, SUBCOMM. ON PATENTS, TRADEMARKS, AND COPYRIGHTS, SENATE COMM. ON THE JUDICIARY, 86th Cong., 2d Sess. 3-17 (Comm. Print 1958) [hereinafter cited as STATUTORY STANDARD]. The author sets out legislative history in detail.

language drawn from *Hotchkiss*.[23] The new statute, codified as 35 U.S.C. § 103, based the determination of patentability upon whether the device "would have been obvious at the time the invention was made to a person having ordinary skill in the art . . . ."[24]

Congress left unsettled, however, the question to what extent section 103 codified recent Supreme Court decisions. What some have termed persuasive evidence points to an intent simply to codify all existing patent law, presumably incorporating all relevant Supreme Court decisions.[25] That view cannot be supported without qualification, however.[26] For example, language making immaterial "the manner in which the invention was made" is plainly aimed at *Cuno Engineering,* as the Reviser's Note makes clear.[27] Also, the reports of both the House and Senate Committees explained section 103 primarily by restating it, but added, "This section should have a stabilizing effect and minimize great departures which have appeared in some

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[23] *Id.* Among the proposed standards were a "nature of the contribution" test, *id.* at 3, "long-felt want," *id.* at 7, and "routine skill", *id.* at 9. *Compare* note 24 *infra* (§103) *with* text accompanying note 7 *supra (Hotchkiss).*

[24] 35 U.S.C. §103 (1976).

> A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Id.

[25] When he presented the bill to the Senate, Sen. Wiley said, "The bill simply constitutes a restatement of the patent laws of the United States." 98 CONG. REC. 9097 (1952). Later, Sen. Saltonstall asked Sen. McCarran, who had taken up the bill, "Does the bill change the law in any way or only codify the present patent laws?" Sen. McCarren replied, "It codifies the present patent laws." *Id.* at 9323.

[26] Rep. Crumpacker, a member of the House Subcommittee on Patents, described the above-quoted exchange: "This colloquy is almost entirely meaningless, it being merely an exchange of pleasantries by some senators having little, if any, familiarity with the subject matter they were discussing." *Quoted in* Rich, *Congressional Intent – Or, Who Wrote the Patent Act of 1952,* in PATENT PROCUREMENT AND EXPLORATION 61 (BNA 1963), *reprinted in* NONOBVIOUSNESS — THE ULTIMATE CONDITION OF PATENTABILITY 1:1, 1:12 (J. Witherspoon, ed. 1980 [hereinafter cited as NONOBVIOUSNESS]).

[27] "[I]t is immaterial whether the invention resulted from long toil and experimentation or from a flash of genius." 35 U.S.C. §103 (1976) (Reviser's Note).

cases."[28] Although that language perhaps was designed to avoid direct criticism of a coordinate branch of government, the evidence, taken together with the deliberate choice of language from the original "invention" case, not a recent one, certainly permits the inference that Congress believed the Court had construed the standard of invention too narrowly in recent cases.

Opinions on the extent to which the standard had been rolled back were mixed. Examiner-in-Chief Federico commented on the Act for United States Code Annotated, and he suggested that Congress intended "moderating the extreme degrees of strictness exhibited by a number of judicial opinions over the past dozen or more years...."[29] Some courts, on the other hand, believed that Congress had not changed the standard of invention at all, and that *A&P* remained valid.[30] The most significant trend was led by Judge Learned Hand of the Second Circuit. In a series of decisions, Judge Hand developed the view that Congress had acted to "reinstate" *Hotchkiss* in its "original gloss."[31] He also proposed the use of "sign posts," such as a long-felt need for the device, its commercial success, and the failure of other inventors as indicators of "invention."[32]

Definitive construction of section 103 did not come until 1966, when the Supreme Court evaluated three patents in the companion

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[28] S. REP. NO. 1979, 82d Cong., 2d Sess. 6, *reprinted in* [1952] U.S. CODE CONG. & AD. NEWS 2400 [hereinafter cited as S. REP.]. *See* note 74 *infra*.

[29] Federico, *Commentary on the New Patent Act,* in 35 U.S.C.A. 22 (West 1954).

[30] *See, e.g., Interstate Rubber Prods. Corp. v. Radiator Specialty Co.,* 214 F.2d 546, 547-48, 102 U.S.P.Q. 224, 226 (4th Cir. 1954) (*A&P* rule "not changed by the revision of the patent statute"); *General Motors Corp. v. Estate Stove Co.,* 203 F.2d 912, 918, 97 U.S.P.Q. 88, 92 (6th Cir.) (*A&P* "principle... is not modified by the new act") *'cert. denied'* 346 U.S. 822 (1953).

[31] *Lyon v. Bausch & Lomb Optical Co.,* 224 F.2d 530, 536-37, 106 U.S.P.Q. 1, 7 (2d Cir.), *cert. denied,* 350 U.S. 911 (1955).

[32] *Reiner v. I. Leon Co.,* 285 F.2d 501, 503-04, 128 U.S.P.Q. 25, 27-28 (2d Cir. 1960).

> The test laid down is indeed misty enough. It directs us to surmise what was the range of ingenuity of a person 'having ordinary skill' in an 'art' with which we are totally unfamiliar, and we do not see how such a standard can be applied at all except by recourse to the earlier work in the art, and to the general history of the means available at the time.... There are indeed some sign posts: e.g., how long did the need exist; how many tried to find the way; how long did the surrounding and accessory arts disclose the means; how immediately was the invention recognized as an answer by those who used the new variant?

Id. See also Norman v. Lawrence, 285 F.2d 505, 506 128 U.S.P.Q. 28, 29 (2d Cir. 1960) (L. Hand, J.).

cases of *Graham v. John Deere Co.*[33] and *United States v. Adams.*[34] The rationale, set out in *Graham,* tried to accomplish three objectives: First, the debate about whether section 103 changed the standard of invention was addressed: it did not.[35] Second, the Court laid out a three-step test to determine obviousness under section 103:

> the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined.[36]

Finally, the Court relegated Judge Hand's "sign posts" to ancillary status as "secondary considerations."[37] The Court applied the new test to two mechanical combinations in *Graham* and found them obvious.[38] In *Adams,* however, the same test served to uphold a patent claiming the combination of two chemicals in a battery.[39]

Although *Graham* constituted a giant step toward lucid analysis of combination patents, it also sowed the seeds of future confusion. Notwithstanding the advantages of the *Graham* factual determinations over the search for "that impalpable something," areas of ambiguity remained. Most critically, the Court left the door open to subjective judicial rule-making, because after the fact-finding was complete, "the ultimate question of patent validity is one of law."[40] Added to the assertion that the standard of patentability is a constitutional standard, the Court left a gap between the objective measurement that Congress mandated and the final determination of validity; that gap

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[33] 383 U.S. 1, 148 U.S.P.Q. 459 (1966).

[34] 383 U.S. 39, 148 U.S.P.Q. 479 (1966).

[35] 383 U.S. at 17, 148 U.S.P.Q. at 467.

> We believe that this legislative history, as well as other sources, shows that the revision was not intended by Congress to change the general level of patentable invention. We conclude that the section was intended merely as a codification with congressional directions that inquiries into obviousness of the subject matter sought to be patented are a prerequisite to patentability.

Id. (footnotes omitted). *See* note 74 *infra.*

[36] 383 U.S. at 17, 148 U.S.P.Q. at 467.

[37] *Id.* at 17-18, 148 U.S.P.Q. at 467.

[38] *Id.* at 19-37, 148 U.S.P.Q. at 467-74. The patents concerned a spring clamp for plow shanks, *id.* at 19-26, 148 U.S.P.Q. at 467-70 and a finger sprayer for household liquid dispensers, *id.* at 26-37, 148 U.S.P.Q. at 74.

[39] 383 U.S. at 52, 148 U.S.P.Q. at 483-84.

[40] 383 U.S. at 17, 148 U.S.P.Q. at 467.

left ample room for notions of "invention" to reassert themselves.[41] Further, the status of the "sign posts" was not settled as decisively as an initial reading might suggest. Although clearly labeled "secondary," the Court suggested that they "might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquiries may have relevancy."[42] Left unexplained are the circumstances that make these inquiries proper, their role in the analysis — substantive assistance or merely buttressing the conclusion — and their weight. In addition, the Court sidestepped the issue of the "general level of patentable invention." The bald assertion that the standard had actually "remained invariable" failed to address the concerns that had motivated the adoption of section 103.[43] Citation to *A&P* further muddied the water by leaving the exact status of that case unclear.[44]

Moreover, the Court offered only negative guidance concerning mechanical combinations. The only patent upheld was for a chemical combination in *Adams*. The *Lincoln Engineering* problem of mechanical combinations was not addressed.[45] Lower courts and the practicing

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[41] *See* note 74 *infra*.

[42] 383 U.S. at 17-18, 148 U.S.P.Q. at 467. The Court cited, however, a law review note highly favorable to using "secondary considerations," Note, *Subtests of "Nonobviousness": A Nontechnical Approach to Patent Validity,* 112 U. PA. L. REV. 1169 (1964). *See* note 160 *infra*.

[43] *See* STATUTORY STANDARD, *supra* note 22. The Court said, "[w]e have been urged to find in §103 a relaxed standard, supposedly a congressional reaction to the 'increased standard' applied by this Court in decisions over the last 20 or 30 years. The standard has remained invariable in this Court." 383 U.S. at 19, 148 U.S.P.Q. at 467.

That statement, however, ignored also the fact that the draftsmen of §103 certainly believed they were changing the standard from that enunciated in *A&P*. Judge Giles Rich, one of the moving forces within the Drafting Committee, recounts that *A&P* was released while the Committee was meeting, and the opinion "clinched the decision to enact a statutory substitute that would make more sense, . . . would restrict the courts in their arbitrary, a priori judgments on patentability, and that, above all, would serve as a uniform *standard of patentability*." Rich, *Laying the Ghost of the "Invention" Requirement,* 1 APLA Q.J. 26 (1972), *reprinted in* NONOBVIOUSNESS, *supra* note 26, at 1:501, 1:508 (emphasis in original).

See also note 74 *infra*.

[44] The opinion cites *A&P* for the propositions that there exists a constitutional standard of patentability (citation to Mr. Justice Douglas' concurrence), 383 U.S. at 6, 148 U.S.P.Q. at 462; that imprecision of definition is inherent in the "invention" concept, 383 U.S. at 12, 148 U.S.P.Q. at 464; and that the determination of patent validity is a question of law, 383 U.S. at 17, 148 U.S.P.Q. at 467.

[45] *Compare* text accompanying note 14 *supra with* text accompanying note 36 *supra*. The two rules are not congruent, yet the Court's insistence that the level of invention had remained constant left the status of *Lincoln Engineering* in doubt.

bar still did not know what mechanical combinations *could* be patented.

The upshot of *Graham* was a semblance of order. Congress had enacted a standard, and the Court had formulated objective guidelines to implement that standard. Beneath the surface, however, lay the potential for confusion.

C. Synergism

The first signs of that confusion were not long in appearing. A combination patent for a paving apparatus had been issued, the key element of which was inclusion of a radiant-heat burner for solving the problem of cold asphalt joints between pours. The Fourth Circuit had applied the *Graham* test in detail and had upheld the patent in *Anderson's-Black Rock, Inc. v. Pavement Salvage Co.*[46] Although the Supreme Court repeated the necessity for "'strict observance'" of the *Graham* standards, the grounds for reversal were that the combination "added nothing to the nature and quality of the radiant-heat burner already patented."[47] Mr. Justice Douglas, for the Court, did not confine himself to a *Graham* analysis, however. Citing *Lincoln Engineering,* he also criticized the patent because the combination "did not produce a 'new or different function.'" He continued, "a combination of elements may result in an effect greater than the sum of the several effects taken separately. No such synergistic result is argued here."[48] Thus, was the term "synergistic" introduced, without explanation, definition, or application.

The importance of the new term was emphasized in *Sakraida v. Ag Pro, Inc.* in 1976.[49] The patent at issue claimed a cleaning system for dairy barns, featuring a tank which released water in a sheet across the floor, thereby removing animal waste without hand labor. The district court had invalidated the patent based on *Graham,* but the Fifth Circuit had reversed because the evidence did not support the factual findings. In addition, the Fifth Circuit had observed that the

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[46] 404 F.2d 450, 159 U.S.P.Q. 513 (4th Cir. 1968), *rev'd,* 396 U.S. 57, 163 U.S.P.Q. 673 (1969). Chief Judge Haynsworth, speaking for a divided panel, relied on *Graham,* but also he believed that the inquiry would be "facilitated" by the "secondary considerations," and he leaned on them heavily. *Id.* at 452, 159 U.S.P.Q. at 515-16. *See* note 160 *infra.*

[47] 396 U.S. 57, 61-62, 163 U.S.P.Q. 673, 674 (1969).

[48] *Id.* at 61, 163 U.S.P.Q. at 674.

[49] 425 U.S. 273, 189 U.S.P.Q. 449 (1976).

combination "does achieve a synergistic result."[50] The Supreme Court, through Mr. Justice Brennan, disagreed on both counts. First, the Court upheld the district court's findings, because combination patents must be scrutinized especially closely, quoting *A&P*.[51] Then, Justice Brennan flatly rejected the conclusion that the result was synergistic, but he offered no analysis beyond a repetition of Douglas' *Black Rock* language.[52]

Two facets of the Court's reasoning deserve comment. First, the Court relegated *Graham* to a back seat. The *Graham* standard envisioned no such hyper-strict scrutiny of combinations. That idea arose from *A&P*,[53] and application of that scrutiny effectively emasculates *Graham*. Second, the Court never considered the positive criteria advanced in *Adams* to indicate how a combination can meet the *Graham* test. Thus, there was no real inquiry into the obviousness of using a surge of water in a sheet to clean floors. Instead, the Court relied on the fact that water, tanks, and gravity were employed; because they all had been used before, the patent was held invalid.[54]

Other cases that Term heightened the confusion left by *Sakraida*. A matter of weeks before *Sakraida*, the Court had decided another combination patent case, *Dann v. Johnston*.[55] The patent was invalidated,

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[50] 474 F.2d 169, 169, 177 U.S.P.Q. 106, 106 (5th Cir. 1973), *rev'd*, 425 U.S. 273, 189 U.S.P.Q. 449 (1976).

[51] 425 U.S. at 281 189 U.S.P.Q. at 452. The *A&P* Court had said, "[c]ourts should scrutinize combination claims with a care proportioned to the difficulty and improbability of finding invention in an assembly of old elements," 340 U.S. at 152, 87 U.S.P.Q. at 306.

[52] "[T]his patent simply arranges old elements with each performing the same function it had been known to perform, although perhaps producing a more striking result than in previous combinations. Such combinations are patentable under standards appropriate for a combination patent." 425 U.S. at 282, 189 U.S.P.Q. at 452.

[53] Although the *Graham* Court recognized the difficulty of applying its tests, it also said, "The difficulties, however, are comparable to those encountered daily by the courts in such frames of reference as negligence and scienter. We believe that strict observance of the requirements laid down here will result in that uniformity and definiteness which Congress called for in the 1952 Act." 383 U.S. at 18, 148 U.S.P.Q. at 467. In applying the test to the patents in question, the Court did not call for a high standard of proof. *Id.* at 19-37, 148 U.S.P.Q. at 467-74. The same is true of the Court's application of the test in *Adams*. 383 U.S. at 39, 148 U.S.P.Q. at 479.
The Court's use of "strict scrutiny" produces results akin to its use of that test elsewhere: "'strict' in theory and fatal in fact." Gunther, *Foreword: In Search of Evolving Doctrine on a Changing Court: A Model for a Newer Equal Protection*, 86 HARV. L. REV. 1 (1964).

[54] 425 U.S. at 282, 189 U.S.P.Q. at 452.

[55] 425 U.S. 219, 189 U.S.P.Q. 257 (1976).

but Mr. Justice Marshall grounded his reasoning on a straightforward application of *Graham,* never mentioning the term "synergistic."[56] Later that year, however, Mr. Justice White, joined by Mr. Justice Brennan, dissented from a denial of certiorari in *Roanwell Corp. v. Plantronics, Inc.*[57] The district court had upheld the patent, and the Second Circuit had affirmed. The dissenters objected that "the District Court here made no finding that the combination produced a synergistic or any other nonobvious result." They characterized that failure as a "significant departure from longstanding principles of patent law."[58]

Synergism thus emerges as an enigma. The Supreme Court has never defined it except by showing what it is not. Nor has the Court provided an example of what might constitute a synergistic result. Indeed, there seems to be some disagreement that such a standard exists.[59]

III. DIMENSIONS OF THE PROBLEM

Much of the confusion surrounding synergism can be attributed to the fact that, at heart, the question is one of public policy. The real issue is not whether combinations must exhibit a "synergistic result," but rather, what sorts of combinations justify the grant of a patent. It will be helpful at this point to examine several dimensions of the problem.

A. The philosophical dimension

The patent system is essentially an economic institution, and as

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[56] *Id.* The Court did not cite *Black Rock.*

[57] 429 U.S. 1004, 192 U.S.P.Q. 65 (1976) (White, J., dissenting).

[58] *Id.* at 1006-09, 192 U.S.P.Q. at 66-67. The dissenters especially were upset that the district court had made use of the "secondary considerations," including need, prior failure, and commercial success. *Id.* at 1007, 192 U.S.P.Q. at 66.

[59] Although not a traditionally effective argument, part of the problem of inconsistency posed by the foregoing cases might be that the Supreme Court simply has paid little attention to patent cases. *See* B. WOODWARD & S. ARMSTRONG, THE BRETHREN 419 (1979).

The authors characterize *Sakraida* as "of no significance, not even posing interesting questions in the arcane field of patent law." *Id.* As told, the Chief Justice assigned the case to Justice Brennan instead of the junior justice, and Brennan was so humiliated that he would not allow his clerks to help him with the opinion. *Id.* Regardless of the truth of the matter asserted, the account probably does reflect the attitude of the authors' sources, Supreme Court law clerks, and it suggests a less-than-total commitment to careful analysis of patent matters.

such it has been caught up in economic debate since its inception.[60] The increasing politicization and polarization of economic debate since the Depression have included the patent system, and the debate often has been heated.[61] Participants have labelled one another as "paranoid"[62] or "schemers,"[63] and have variously praised the system as having "importantly contributed to our technological growth"[64] and denounced it as "neither strong nor reliable."[65]

Such debate is healthy and necessary; the difficulty arises when economic philosophy is substituted for judicial reasoning. When, for example, Mr. Justice Douglas characterized patents as "the grant of a privilege of exacting tolls from the public,"[66] he left little doubt about the preconceptions he brought to patent adjudication. In the opposite direction, members of the patent bar and bench have vigorously attacked the "nonsense" they saw embodied in judicial and general discussion of the standard of invention.[67]

Historically, the invention standard carried the courts' ideological and philosophical freight. Judges feared that a loose standard would "rather obstruct than to stimulate invention," resulting in a "heavy tax upon the industry of the country" springing from "fears and ap-

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[60] *See Graham,* 383 U.S. at 6-10, 148 U.S.P.Q. at 463. The Court discussed the early controversy surrounding the patent system, focusing on Jefferson's changing viewpoint. *Id.* The Court cited a valuable source, Federico, *Operation of the Patent Act of 1790,* 18 J. PAT. OFF. SOC'Y 237 (1936).

[61] *Compare* W. HAMILTON, PATENTS AND FREE ENTERPRISE, TNEC MONOGRAPH NO. (1941) *with* G. FOLK, PATENTS AND INDUSTRIAL PROGRESS (1941). The former, written by a Yale professor, achieved considerable notoriety as a full-scale attack on the patent system, and Mr. Justice Douglas cited it with approval in *Cuno Engineering,* 314 U.S. at 92, 51 U.S.P.Q. at 275. The latter author was a prominent member of the patent bar, and in a detailed analysis of the entire Temporary National Economic Committee (TNEC) inquiry, he undertook a point-by-point refutation of Hamilton, at 77-106. Folk summed up Hamilton's work as "twaddle." *Id.* at 105.

See also V. ABRAMSON, THE PATENT SYSTEM: ITS ECONOMIC AND SOCIAL BASIS, STUDY NO. 26, SUBCOMM. ON PATENTS, TRADEMARKS, AND COPYRIGHTS, SENATE COMM. ON THE JUDICIARY, 86th Cong., 2d Sess. (Comm. Print 1960).

[62] Markey, *The Status of the U.S. Patent System – Sans Myth, Sans Fiction,* 59 J. PAT. OFF. SOC'Y 164, 171 (1977).

[63] *A&P,* 340 U.S. at 155, 87 U.S.P.Q. at 307 (Douglas, J., concurring) (quoting Bradley, J., in *Atlantic Works v. Brady,* 107 U.S. 192, 200 (1882)).

[64] Bowes, *Patents and the Public Interest,* 61 A.B.A.J. 1521, 1524 (1975).

[65] Nash, *Remarks Before the Industrial Research Institute,* 59 J. PAT. OFF. SOC'Y 143, 146 (1977).

[66] *A&P,* 340 U.S. at 154, 87 U.S.P.Q. at 306 (Douglas, J., concurring).

[67] *See, e.g.,* Rich, *Principles of Patentability,* 28 GEO. WASH. L. REV. 393 (1960).

prehensions of concealed liens and unknown liabilities to lawsuits and vexatious accounts for profits made in good faith."[68] Having a proper egalitarian abhorrence of "monopolies,"[69] courts put their philosophies to work weeding out "gadgets"[70] from the patent rolls.

Section 103 and the *Graham* test seemed to divest courts of discretion to check what they viewed as overindulgence toward inventors by

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[68] *Atlantic Works v. Brady,* 107 U.S. 192, 200 (1882) (Bradley, J.). The irony underlying the frequent judicial repetition of Mr. Justice Bradley's stirring language is that the same courts seem unwilling to examine the facts to determine, in particular cases, whether the patentee indeed is a "speculative schemer" and whether the infringer has made his profits in "good faith." In *Sakraida,* for example, the Fifth Circuit found that the inventor had produced a worthwhile device that contributed to the art. The accused infringer, on the other hand evidently had been employed by the patentee in installing the cleaning systems, then struck out on his own, copying the devices. 437 F.2d 99, 100, 168 U.S.P.Q. 481, 481-82 (5th Cir. 1971) (on appeal from grant of summary judgment; later decided on merits and appealed). One is left with the question which party was the schemer.

Similarly, courts engage in little economic analysis of the effect of patent decision. *See generally* Schneider, *supra* note 3. An economic view would focus on the desirability of spurring investment and further research, rather than asking whether a given inventor deserves the "reward" of a patent. *See* Kitch, *The Nature and Function of the Patent System,* 20 J.L. & ECON. 265, 284 (1977).

[69] "Jefferson, like other Americans, had an instinctive aversion to monopolies." *Graham,* 383 U.S. at 7, 148 U.S.P.Q. at 463. Critics of the patent system press for continued use of the term "patent monopoly." *See* Irons & Sears, *The Constitutional Standard of Invention – Touchstone for Patent Reform,* 1973 UTAH L. REV. 653, 669-78 [hereinafter cited as *Constitutional Standard*]. To the contrary, Deller concludes that "a patent grant should never be referred to as a monopoly — even a legal monopoly." 1 DELLER'S WALKER, *supra* note 8, § 6.

The basis for the "monopoly" idea, however, is the notion that ideas cannot be the subject of property, a concept espoused but later rejected by Jefferson. *Graham,* 383 U.S. at 7-10, 148 U.S.P.Q. at 463. However one evaluates the historical arguments of Irons & Sears, *supra,* versus Deller, *supra,* the property argument has been settled: "[P]atents shall have the attributes of personal property." 35 U.S.C. § 261 (1976). Further, a recent statement by the Deputy Assistant Attorney General, Antitrust, hardly a "pro-patent" source, should be dispositive: "[T]he notion that whenever an inventor receives a patent he has been awarded a monopoly s false. A patent confers a right to exclude." Ewing, *Antitrust Enforcement and the Patent System: Similarities in the European and American Approach,* 11 INT'L. REV. INDUS. PROP. & COPYRIGHT L. 279, 283 (1980).

[70] Mr. Justice Douglas complained, "The Patent Office . . . has placed a host of gadgets under the armour of patents — gadgets that obviously have had no place in the constitutional scheme of advancing scientific knowledge." *A&P,* 340 U.S. at 156, 87 U.S.P.Q. at 307 (Douglas, J., concurring). *But see* Rich, *Escaping the Tyranny of Words – Is Evolution in Legal Thinking Impossible?* in NONOBVIOUSNESS, *supra* note 26, at 3:301, 3:309 (contra).

the Patent and Trademark Office.[71] The solution was to resurrect the "invention" standard under a new name, "synergistic result." That synergism has stepped into the shoes of invention is manifest from its first use, Mr. Justice Douglas' statement in *Black Rock,* in which he used it as shorthand for the *Lincoln Engineering* rule, itself a product of "invention."[72] *Sakraida* followed suit, additionally emphasizing *A&P*.[73] The outcome is an attempt to circumvent objective evaluation of patentability by returning to the invention standard, with judges once more taking up a quixotic search for "that impalpable something."[74]

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[71] Mr. Justice Douglas's views are echoed by some contemporary judges. *See* Nash, *supra* note 65, at 146-47.

[72] *See* notes 14, 48 *supra* and accompanying text.

[73] *See* notes 49, 52 *supra* and accmpanying text.

[74] Debate about the course taken by the Supreme Court is articulated comprehensively in two recent articles. *Compare* Sears, *Combination Patents and 35 U.S.C.* § 103, 1977 DET. C.L. REV. 83 (favoring Douglas's view) *with* Mintz, *supra* note 12 (favoring liberal view).

Defense of the *Sakraida* position rests on the two conclusions that the standard of invention mandated by the Court has remained "invariable," and that Congress did not change the test of invention by the Patent Act of 1952. These conclusions draw support from the cognate idea that the test of invention has constitutional basis, dealt with separately at note 82 *infra.*

The contention that the standard of invention has remained "invariable" flies in the face of historical fact. Not only do modern scholars see a tightening of the standard during the pre-War years, *see* Mintz, *supra* note 12, at 775, but also the overwhelming testimony from that period agrees. The conclusion of the National Patent Planning Commission, note 21 *supra,* the opinion of at least one Justice, *see* note 20 *supra,* and the concerns aired before Congress, *see* STATUTORY STANDARD, *supra* note 22, at 3-15, all eloquently point to a perception of tightening standards by the Supreme Court. The *Graham* Court's assertion that the standard of patentability had remained "invariable" is at best disingenuous.

Similarly, the assertion that Congress did not change the test of invention cannot withstand analysis of either the Act or the *Graham* opinion. Mr. Justice Clark noted the congressional hope that the addition of section 103 would have a "stabilizing effect," *see* text accompanying note 28 *supra,* but he went on to disregard the plain meaning of those words, that Congress acted to impose a standard of patentability different from that being used by the Court. Sears, *supra,* at 100 n.80, explains the same congressional language as the work of "patent coalitionists," whom she defines as the patent bar, Patent Office, and the Court of Customs and Patent Appeals, working in concert, *id.* at 83 n.3. But notwithstanding the assertion of invariability, the *Graham* Court acknowledged that Congress had changed the test of invention from the *A&P* standard to nonobviousness. The Court's test is keyed to section 103, not the standard of *Lincoln Engineering* or *A&P*.

What supporters of *A&P* and *Sakraida* miss is the fundamental distinction between the *standard* of invention and the *test* of invention. The former is the general level of

The challenge thus presented is to penetrate the veil of rhetoric to discern what courts mean when they speak of "synergism." By beginning with the understanding that the term is no more than a modern version of "invention," it will be possible to evaluate the permissibility and efficacy of the standard.

B. The constitutional dimension

The question whether the standard of invention rises to constitutional magnitude has far-reaching implications, for the issue is plainly whether that standard is regulated by the Congress or the courts.[75] The constitutional language seems straightforward: Congress has "Power... To promote the Progress of Science and useful Arts."[76] If that language gives Congress the power to set the standard of invention, the role of the judiciary is limited to an initial determination that the patent statute is designed rationally to promote progress, followed by case-by-case assessments whether individual patents meet the statutory standard. If the standard is a constitutional one, however, courts are free to fashion a test independent of Congress, to insure that each patent promotes progress in the useful arts. The question is, therefore, central to inquiry into the standard of invention.

The assertion that the standard of invention is constitutional presents a classic case of judicial bootstrapping. The basic source for that assertion is *Graham v. John Deere Co.*, in which Mr. Justice Clark, in the majority opinion, flatly stated that the standard is constitutional.[77]

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patentability — what sorts of devices merit patent protection. Most patent practitioners support a high level of invention; for example, few persons disagreed with the result of *A&P*. *See* Rich, note 43 *supra*. The test of invention, the analytic tools for applying the standard, is a separate matter. What *A&P*, *Sakraida*, and Ms. Sears advocate is freedom for courts to implement the standard of invention based on little more than visceral reaction. What the *Hotchkiss* Court, section 103, and *Graham* mandate is a much more confined analysis, demanding that the court adopt a vantage point contemporaneous with the inventor to determine nonobviousness. One cannot rationally maintain that the *A&P* or *Sakraida* tests (as distinct from their standard) comport with section 103.

[75] Defenders of Mr. Justice Douglas's view do not shrink from the charge that the Court has virtually ignored Congress. Sears, *supra* note 74, at 86, said, "Just as *Sakraida* is essentially a rehash of *Black Rock*, ... so *Black Rock* in its turn is a reiteration of *A&P*." Implicit in that reasoning is the contention that section 103 had no effect whatsoever on the analysis of combination patents.

[76] U.S. CONST. art. I, § 8, cl. 8.

[77] 383 U.S. 1, 6 148 U.S.P.Q. 459, 464 (1966).

> Innovation, advancement, and things which add to the sum of useful knowledge are inherent requisites in a patent system which by con-

As authority for his assertion, however, Justice Clark's only citation was to Justice Douglas' concurrence in *A&P,* which argued for a constitutional standard but did not establish any constitutional basis for it. What Justice Douglas did say was this: "The standard of patentability is a constitutional standard; and the question of validity of a patent is a question of law. *Mahn v. Harwood,* 112 U.S. 354, 358."[78] The cited case, however, does not support the idea of a constitutional standard; rather, it supports the *second* clause of the sentence.[79] Thus, Mr. Justice Douglas seems, on paper, to have backed up the idea of a constitutional standard with longstanding authority; actually, he advanced a completely new idea. Further, Justice Douglas cited several cases for the proposition that the Court has "taken 'inventive genius' as the test" of patentability;[80] with the exception of Douglas' own *Cuno Engineering* opinion, however, not one of the cases even mentions the Constitution, much less establishes a constitutional standard.[81] To the

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> stitutional command must 'promote the Progress of... useful Arts.' This is the *standard* expressed in the Constitution and it may not be ignored. And it is in this light that patent validity 'requires reference to a standard written into the Constitution.' *A. & P. Tea Co. v. Supermarket Corp., supra* at 154 (concurring opinion).

Id. (emphasis in original).

[78] *Great Atlantic & Pacific Tea Co. v. Supermarket Equip. Co.,* 340 U.S. 147, 154, 87 U.S.P.Q. 303, 306 (1950) (Douglas, J., concurring). Douglas cited to *Mahn v. Harwood,* 112 U.S. 354, 358 (1884) (Bradley, J.). That case says, "[i]n cases of patents for inventions, a valid defense often arises where the question is, whether the thing patented amounts to a patentable invention. This being a question of law, the courts are not bound by the decision of the commissioner, although he must necessarily pass on it." *Id.* (citations omitted). The Constitution is not mentioned on the cited page, nor in the rest of the case.

[79] *Id.*

[80] *A&P,* 340 U.S. at 154, 87 U.S.P.Q. at 306 (Douglas, J., concurring).

[81] In the order in which Justice Douglas cited them, *id.,* and with full citations and short discussions of rationale added, the cases were as follows:

Reckendorfer v. Faber, 92 U.S. (11 Otto) 347 (1875). The Court overturned a patent, but based its reasoning on a determination that the commissioner had exceeded his authority in issuing it, not on a constitutional standard. *Id.* at 352-54.

Smith v. Whitman Saddle Co., 148 U.S. 674 (1893). The Court began its analysis by setting out the statute and proceeded to construe it without mentioning the Constitution. *Id.* at 677-78.

Potts v. Creager, 155 U.S. 597 (1895). The Court discussed the invention requirement, which it saw as stemming from *Hotchkiss,* without mentioning the Constitution. *Id.* at 608.

Concrete Appliances Co. v. Gomery, 269 U.S. 177 (1925). The Court based its decision on a detailed analysis of the prior art and application of the rule from *Atlantic Works*

contrary, the cases make clear that the Court was interpreting the statute, not the Constitution.[82]

Furthermore, Justice Douglas' *A&P* concurrence was demonstrably wrong on constitutional principle. He asserted that patents "had to serve the ends of science .... Patents serve a higher end — the ad-

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Co. v. Brady, 107 U.S. 192 (1882), without mentioning the Constitution. *Id.* at 185.

Mantle Lamp Co. v. Aluminum Prods. Co., 301 U.S. 544 (1937). The decision was based on prior art; the Court did not cite the Constitution. *Id.* at 546.

Cuno Engr. Corp. v. Automatic Devices Corp., 314 U.S. 84, 51 U.S.P.Q. 272 (1941). Mr. Justice Douglas referred to the "level of inventive genius whch the Constitution authorizes Congress to reward." *id.* at 91, 51 U.S.P.Q. at 275, but he cited no cases for that assertion.

Also, Mr. Justice Douglas quoted at length from *Atlantic Works Co. v. Brady,* 107 U.S. 192 (1882), in which Mr. Justice Bradley expressed his fears about the consequences of a loose standard, *see* note 68 *supra.* That language, however, was expressed as furthering "the design of the patent laws." 107 U.S. at 200. Mr. Justice Bradley did not mention the Constitution.

The cases above constitute every citation made in the course of Mr. Justice Douglas's argument for a constitutional standard. 340 U.S. at 154-55, 87 U.S.P.Q. at 306-08. Not one case supports the notion of such constitutional basis. The only possible exception is Douglas's own unsupported dictum in *Cuno Engineering.*

[82] Notwithstanding Justice Douglas's failure to back up his assertion of a constitutional basis for the invention standard, *see* note 81 *supra,* his supporters continue to read such a rule into early Supreme Court cases. In *Constitutional Standard, supra* note 69, at 656, Ms. Sears (author of the article, *supra* note 74) and Mr. Irons said, "the Court was not, as some writers erroneously assert, making a startling or novel assertion of constitutional law. On the contrary, the Court as early as 1885 had agreed that the *Constitution* requires that subject matter, to be patentable, must transcend the ordinary level of skill in the art." *Id.* (footnotes omitted, emphasis in original). The authors cited two cases for that proposition. *Id.* at 656 n.16.

The first, *Thompson v. Boisselier,* 114 U.S. 1 (1885), does state that an invention "must, under the Constitution and the statute, amount to an invention or discovery." *Id.* at 11. That language, however, concludes a paragraph which begins by quoting the Constitution and proceeds to trace the statutory terms that effectuated the Constitution. Although the case mentions the Constitution, no constitutional standard was advocated; rather, the Court interpreted the statute.

The second case, *Hollister v. Benedict & Burnham Mfg. Co.,* 113 U.S. 59 (1885), likewise mentioned the Constitution, calling the device in question "in no sense the creative work of that inventive faculty which it is the purpose of the Constitution and the patent laws to encourage and reward." *Id.* at 73. Again, this statement does not stand alone, or even function as a rule of decision. It is the last sentence of a decision that stated and explicated the patent statute. *Id.*

The fact that the word "Constitution" appears in a case dealing with lack of invention under the patent statutes does not establish a constitutional standard of invention. What these cases show is the the early Court envisioned its role as interpreting and applying the statutes enacted under the constitutional grant of power. There is a long jump from the approach of these cases to that of *A&P* or *Sakraida.*

vancement of science."[83] To the contrary, the records of the Constitutional Convention show that the Framers lumped copyrights and patents together in one clause — the former to promote "science" and the latter to promote useful arts.[84] Thus, when Justice Douglas spoke of the promotion of "science" as a prerequisite to a patent grant, he simply misstated the law.

The effect of Mr. Justice Clark's statement in *Graham* was to place the imprimatur of a majority opinion on dictum that had never won the approval of a majority of the Court. A close analogy would be for a current Justice to state boldly that the Fourteenth Amendment incorporates the entire Bill of Rights, citing only one of Mr. Justice Black's well-known concurrences on that point.[85]

The assertion in *Graham* is itself dictum,[86] but it has been cited to support the constitutional basis of the invention requirement several times since 1966. Mr. Justice Douglas, in *Black Rock,* quoted it verbatim.[87] In *Sakraida v. Ag Pro, Inc.,* however, Mr. Justice Brennan went further. He said that "[i]t has long been clear that the Constitution requires that there be some 'invention' to be entitled to patent protection."[88] He cited *Dann v. Johnston* as authority, but *Johnston*

The clincher to this debate can be found in the case which formulated the "invention" standard, and which serves as the model for section 103, *Hotchkiss v. Greenwood,* 52 U.S. (11 How.) 248 (1850). That case was not cited by Justice Douglas, nor by Irons & Sears, because that Court made no pretense of a constitutional basis for the standard; rather, "invention" was derived from the statutory requirement of novelty.

[83] *A&P,* 340 U.S. at 154-55, 87 U.S.P.Q. at 306-07 (Douglas, J., concurring).

[84] The committee reports on the 1952 Act summarized this history and explained the duality of the constitutional language:

> The purpose of the first provision is to promote the progress of science by securing for limited times to authors the exclusive right to their writing, the word 'science' in this connection having the meaning of knowledge in general, which is one of its meanings today. The other provision is that Congress has the power to promote the progress of useful arts by securing for limited times to inventors the exclusive right to their discoveries.

S. REP. *supra* note 28, at 2396. *See also* 1 DELLER'S WALKER, *supra* note 8, § 10 (detailed history of constitutional convention relating to patent clause).

[85] *E.g., Rochin v. California,* 342 U.S. 165, 176-77 (1952) (Black, J., concurring).

[86] The Court reached its decision on the patents in question by applying the three-part test it had formulated, not the pre-1952 invention standard. *See* 383 U.S. at 19-37, 148 U.S.P.Q. at 467-74.

[87] *Anderson's-Black Rock, Inc. v. Pavement Salvage Co.,* 396 U.S. 57, 61, 163 U.S.P.Q. 673, 674 (1969).

[88] 425 U.S. 273, 279, 189 U.S.P.Q. 449, 451-52 (1976).

never so much as mentioned the Constitution.[89] Justice Brennan continued with a quote from *Hotchkiss v. Greenwood;* again, that opinion did not mention the Constitution, but derived the invention standard from the requirement for novelty.[90] The paragraph ended with a quote from *Graham* about the Congressional intent underlying section 103. In all of the discussion following his topic sentence, Mr. Justice Brennan failed to establish the constitutional basis for the invention standard with a single authority.[91]

The Supreme Court's attempt to constitutionalize the question of invention has been done, as it were, with mirrors. Courts have inferred standards of patentability for over a century, basing their reasoning upon the applicable patent statute, and it is indeed late in the day suddenly to discover a constitutional mandate. Rather, the Court should restrict itself to discerning and applying the intent of the legislature, so long as the statute itself is held constitutional.

C. The semantic dimension

Legal lexicons are full of terms of art, words taken from everyday usage and given particular meanings. Generally, though, such terms have generated a body of case law illustrating their meaning, and learned judges or commentators have provided practical definitions. Patent law is no different, with one caveat regarding combination patents: no one has successfully reached a definition of the terms. It is hornbook law, for example, that "mere aggregations" are not patentable;[92] an "aggregation," however, is defined as a combination which fails to show invention,[93] explained in terms of specific devices found not patentable.[94] Synergism, as the successor to "invention,"

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[89] 425 U.S. 219, 225, 189 U.S.P.Q. 257 (1976). "As a judicial test, 'invention' — i.e., 'an exercise of the inventive faculty' — has long been regarded as an absolute prerequisite to patentability." *Id.* (citation omitted). The Court cited *McClain v. Ortmayer,* 141 U.S. 419 (1891), for that proposition. In contrast, the *Ortmayer* Court framed the question it decided as "[w]hat shall be construed as invention within the meaning of the patent laws." 141 U.S. at 426.

[90] 52 U.S. (11 How.) 248, 267 (1850).

[91] *See also Roanwell Corp. v. Plantronics, Inc.,* 429 U.S. 1004, 1005, 192 U.S.P.Q. 65, 66 (1976) (White, J., dissenting from refusal to grant certiorari) ("whether referred to as 'invention' or "nonobviousness,' the requirement is based on the constitutional command").

[92] 2 DELLER'S WALKER, *supra* note 8, § 110.

[93] *See Id.* § 102 *passim.*

[94] *See A&P,* 340 U.S. at 150-51 87 U.S.P.Q. at 305 (discussing esentially negative nature of decisions).

inherited this tradition of definitional vacuity, and it has likewise emerged devoid of substantive content.

The word synergism is derived from the Greek roots syn, meaning together, and ergon, to work.[95] The term is usually employed in chemistry or pharmacology, in which it denotes the combined action of two or more chemical agents, whose total effect is greater than the sum of the effect each would produce individually.[96] The recent case *In re Kollman,* before the Court of Customs and Patent Appeals, illustrates the correct usage of the term.[97] The patent in question concerned an herbicide comprising a combination of chemicals. The court found that the combination possessed a greater herbicidal effect than the total effect of the two constituents taken separately; the combination was synergistic. Because the combination was also not obvious, the court held it to be patentable.[98]

When the concept of synergism is lifted from the realm of chemistry, however, it breaks down. Mr. Justice Jackson tallied up the individual elements of the combination in *A&P,* seeking an effect greater than the sum of the parts and concluded that no "old elements which made up this device perform any additional or different function in the combination than they performed out of it.... Two and two have been added together, and they still only make four."[99] Although eminently quotable, that statement falls short of explaining how a gear, motor, or other mechanical device can ever function differently from a gear or motor.[100] As one judge observed, "[i]n the real world, two plus two

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[95] WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY 2320 (1966).

[96] *Id. See also* P. ROSENBERG, PATENT LAW FUNDAMENTALS 66 (Cum. Supp. 1979) ("synergism is a phenomenon indigenous, if not peculiar, to chemistry and physiology").

[97] 201 U.S.P.Q. 193 (C.C.P.A. 1979).

[98] *Id.* at 198-99.

[99] *A&P,* 340 U.S. at 152, 87 U.S.P.Q. at 306.

[100] *See B.G. Corp. v. Walter Kidde & Co.,* 79 F.2d 20, 22, 26 U.S.P.Q. 288, 289 (2d Cir. 1935) (L. Hand, J.).

> All machines are made up of the same elements; rods, pawls, pitmans, journals, toggles, gears, cams, and the like, all acting their parts as they always do and always must. All compositions are made up of the same substances, retaining their fixed chemical properties. But the elements are capable of an infinity of permutations and the selection of that group which proves serviceable to a given need may require a high degree of originality. It is that act of selection which is the invention.

Id. It was precisely the originality required to bring known elements together in a new way that was the focus in *United States v. Adams,* 383 U.S. 39, 148 U.S.P.Q.

never equals five."[101]

Furthermore, the terms "synergistic" and "nonobvious" are *not* synonymous. The former concerns the effect produced by elements acting together, *after* the combination; the latter addresses the likelihood that a skilled artisan would have used the prior art to make such a combination, *before* the event.[102] The Supreme Court has thus saddled lower courts and practitioners with a term that has no intrinsic meaning in a mechanical context and that actually diverts attention from the statutory inquiry. Moreover, the Court has done so with no guidance whatsoever on the correct application of the term.

IV. GRAPPLING WITH "SYNERGISM"

A. Applying the test

In the main, courts have purported to apply the synergism test, but have not attempted to give the term substantive content. The Eighth

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479 (1966), the companion to *Graham*. Contrast the focus of *A&P, Black Rock,* and *Sakraida,* all of which analyze the device after the combination, seeking a "synergistic result."

101 Conner, *Some Highly Personal Reflections on Section 103,* 5 AM. PAT. L. Q. 77, 85 (1977).

102 *See* notes 127-28 *infra* and accompanying text. That court developed the argument espoused by the sources cited in notes 100-01 *supra.*

But see Sears, *supra* note 74, at 98.

> [W]here inquiry has shown each individual element plus its function, mode of operation and result to be old, this inquiry may show that the *only* difference is that the old elements have been assembled, or that they have been assembled in a particular order, with no change in their respective function or results and an overall additive effect. Alternatively, this inquiry may show that the overall assemblage — *i.e.,* the combination — yields a result that *is not* a mere cumulation of the capabilities, known results, or functions of the individual elements. In such instances the Supreme Court has applied the term "synergistic result."

Id. (emphasis in original).

Two points should be made here. First, the Supreme Court has never applied the term "synergistic result" in a positive manner to show in a concrete mechanical device what those words mean. Ms. Sears does not do so either. Second, that inquiry obviously is directed at the result achieved by old elements, or a change in their function, not on the obviousness of the combination. The antithesis presented by the approach of Ms. Sears, and the *Sakraida, Black Rock,* and *A&P* Courts on one side and that of Judge Hand and the *Adams* Court on the other is brought home in the following statement of Ms. Sears: "[T]he level of ordinary skill at any given time affords the basis for associating old elements in *any* manner which merely takes advantage of their known capabilities." *Id.* at 99 (emphasis in original).

Circuit, for example, simply looked at the facts concerning an improved irrigation system and stated, "[w]e do not agree that this is synergism."[103] Similarly, the Ninth and Sixth Circuits examined an air cargo pallet and a bus seat, respectively, then cited the need for a synergistic result, and proceeded with a *Graham* analysis.[104] Most such cases leave the reader in real doubt about what test the court actually applied. The Tenth Circuit, evaluating a press used to manufacture rail anchors, demanded a "truly synergistic result," but grounded its holding of invalidity on the finding that the prior art showed a "virtually identical" manufacturing system.[105]

Cases in which courts claim to have found synergistic results shed equally little light on the meaning of the term. Upholding a patent on a corn harvester, a district court explained that "synergistic effect is achieved by reason of the fact that the old elements were combined in a manner which had the effect of rewriting the book on the prior art."[106] Another district court found synergism in a design patent for a Christmas tree ornament hanger that was itself ornamental; that effect, said the court, was greater than the sum of the parts.[107] Again, most decisions are unclear about which test has been applied.[108]

Explanations have focused on "synergistic result" rather than on synergism as a process. For example, a method for preserving cottage cheese was called synergistic because it permitted producers to enjoy

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[103] *Reinke Mfg. Co. v. Sidney Mfg. Corp.*, 594 F.2d 644, 201 U.S.P.Q. 344 (8th Cir. 1979).

[104] *See American Seating Co. v. National Seating Co.*, 586 F.2d 611, 199 U.S.P.Q. 257 (6th Cir. 1978), *cert. denied*, 441 U.S. 907 (1979); *Satco, Inc. v. Transequip, Inc.*, 594 F.2d 1318, 202 U.S.P.Q. 567 (9th Cir.), *cert. denied*, 444 U.S. 865 (1979).

See also Herschensohn v. Hoffman, 593 F.2d 893, 201 U.S.P.Q. 721 (9th Cir. 1979). This court cited *Photo Elec. Corp. v. England*, 581 F.2d 772, 199 U.S.P.Q. 710 (9th Cir. 1978) to link synergism with an "unusual or surprising consequence," but the latter court made no such connection.

An interesting result of the distortion of language from normal usage produced by these cases is the "surprising movable car crusher" found in *Mobile Auto Crushers Corp. v. Fjarli*, 197 U.S.P.Q. 620, 626 (D. Or. 1978).

[105] *True Temper Corp. v. CF&I Steel Corp.*, 601 F.2d 495, 202 U.S.P.Q. 412 (10th Cir. 1979). *See also Mattel, Inc. v. Hyatt*, 206 U.S.P.Q. 499 (C.D. Cal. 1979) (cited need for synergistic result but based decision on "minute differences" from prior art).

[106] *Deere & Co. v. International Harvester Co.*, 460 F. Supp. 523, 200 U.S.P.Q. 150 (S.D. Ill. 1978).

[107] *Molinaro v. Birnbaum*, 201 U.S.P.Q. 83 (D. Mass. 1977) ("surprising and synergistic result").

[108] *See, e.g., Hanson v. Alpine Valley Ski Area*, 611 F.2d 156, 204 U.S.P.Q. 803 (6th Cir. 1979). The patent was for a snow-making apparatus that substituted a propeller and water-injection system for the former method using compressed air, pipes,

the benefits of improved preservation without the burdens encountered in using the prior art.[109] Another explication suggested that synergism could be seen in a machine's improved operating characteristics resulting from an improvement of one part.[110]

None of the reported decisions, however, explains how a machine can have a greater effect than the sum of its parts. In view of the confusion, the Third Circuit chose a purely factual approach. The court compared the tomato slicer in question to the barn cleaning system in *Sakraida v. Ag Pro, Inc.*[111] and rejected the patent because it did not "reveal any more of a synergistic result than was found... in *Sakraida*."[112]

B. Finessing the test

Notwithstanding the Supreme Court's emphasis on synergism, several courts have succeeded in maneuvering around it. The Second Circuit, in *Jamesbury Corp. v. Litton Industrial Products, Inc.*, recog-

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and nozzles. The court said the patentee had achieved a "'synergistic result' and therefore, we conclude that although it is a combination method patent, it meets the requirement of non-obviousness...." But the court also applied the "secondary considerations" to demonstrate the result further. *Id.* at 160, 204 U.S.P.Q. at 806.

Conversely, in *Dollar Elec. Co. v. Syndevco, Inc.*, 205 U.S.P.Q. 949 (E.D. Mich. 1979), the court applied *Graham* but because *Sakraida* had mandated *A&P's* close scrutiny test, the court also looked for synergistic results. Because it "produces no new result," the patent was invalidated. *Id.* at 963.

[109] *Sing v. Culture Prods., Inc.*, 204 U.S.P.Q. 848 (E.D.Mo. 1979). The court cited the need for a synergistic result, but said that the result achieved was "greater than the sum of the parts." *Id.* at 853.

[110] See *Duplan Corp., v. Deering Milliken, Inc.*, 444 F. Supp. 648, 197 U.S.P.Q. 342 (D.S.C. 1977), *modified on other grounds*, 594 F.2d 979, 201 U.S.P.Q. 641 (4th Cir. 1979), *cert. denied*, 444 U.S. 1015 (1980).

> Normally all elements, old or new, must of necessity 'co-act' or the machine will not operate. In order to support a finding of invention, however, it must appear that the co-action of the improved element with the old elements has a synergistic effect.... For instance, if a re-designed heater allowed the [apparatus] to operate at substantially greater speeds than had been possible with old heater, the new heater and the old [mechanism] would be 'co-acting' in a manner different from old heaters and old [mechanisms] with the much desired and sought after result of higher production.

Id.

[111] 425 U.S. 273, 189 U.S.P.Q. 449 (1976).

[112] *Systematic Tool & Mach. Co. v. Walter Kidde & Co.*, 555 F.2d 342 (3d Cir. 1977), *cert. denied*, 434 U.S. 857 (1977). The court listed synergism as "one factor to consider in determining obviousness." *Id.* at 347.

nized *Sakraida* and its predecessors, but distinguished them because the patent at issue, for a ball valve used in high temperature applications, did not contain *all* old elements.[113] Judge Gurfein analyzed the patent, which featured an improved seal, primarily in light of *Lincoln Engineering Co. v. Stewart Warner Corp.*[114] and *Williams Co. v. United Shoe Machinery Corp.*[115] The patent was valid, the court held, because "by *cooperation* of the elements claimed, it discloses a new result that represents a marked improvement over prior art."[116] Although the rationale may skate on analytically thin ice, it offers a path around the synergism quagmire.[117]

Arguably, the best results have been achieved by courts that rendered lip service to the synergism test, but which ignored it for purposes of analysis.[118] The Fifth Circuit's decision in *John Zink Co. v. National Airoil Burner Co.*[119] exemplifies this approach. Not only did the court apply straightforward nonobviousness analysis, but also it applied *Graham* as the Supreme Court did in *United States v. Adams*[120] to uphold the patent.[121]

V. TOWARD REJECTION OF THE SYNERGISM TEST

The Seventh Circuit finally faced up to the confusion caused by synergism. Its opinion in *Republic Industries, Inc. v. Schlage Lock Co.*[122] marks a turning point in the adjudication of combination pat-

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113 586 F.2d 917, 199 U.S.P.Q. 641 (2d Cir. 1978).

114 303 U.S. 545, 37 U.S.P.Q. 1 (1938). *See* text accompanying notes 14-15 *supra.*

115 316 U.S. 364, 53 U.S.P.Q. 478 (1942).

116 586 F.2d at 922, 199 U.S.P.Q. at 647.

117 *Accord B&J Mfg. Co. v. Hennessey Indus., Inc.*, 206 U.S.P.Q. 542 (N.D. Ill. 1979). The court followed *Jamesbury's* lead to apply *United Shoe* over *Lincoln Engineering* to uphold a patent. *See also Pate Co. v. RPS Corp.*, 79 F.R.D. 356, 200 U.S.P.Q. 571 (N.D. Ill. 1978) (patent on weather-proof pipe seal not invalid, because elements cooperate to perform function).

118 *See, e.g., Hancock Labs, Inc. v. American Hosp. Supply Corp.*, 199 U.S.P.Q. 279 (N.D. Ill. 1978) (patent on method for implanting heart valves invalid by *Graham* test); *Vetco Offshore Indus., Inc. v. Rucker Co.*, 448 F.Supp. 1203, 200 U.S.P.Q. 525 (N.D. Cal. 1978) (stabilizing device for offshore drilling obvious under *Graham*).

119 613 F.2d 547, 205 U.S.P.Q. 494 (5th Cir. 1980). The court cited the synergistic result rules, but relied on *Adams* to validate a patent on a burner tip for smokeless emission of waste gas.

120 383 U.S. 37, 148 U.S.P.Q. 479 (1966).

121 *See also Santa Fe-Pomeroy, Inc. v. P & Z Co.*, 569 F.2d 1084, 197 U.S.P.Q. 449 (9th Cir. 1978) (relying on *Adams*).

122 592 F.2d 963, 200 U.S.P.Q. 769 (7th Cir. 1979).

ents because the court rejected the use of stock phrases in favor of reasoned analysis. Admitting that it had "failed to provide clear and consistent guidance"[123] to the lower courts, the Seventh Circuit held that "synergism does not comport with the *Graham* mandate to apply section 103."[124]

The court found synergism wanting in three aspects. The first factor was definitional. Synergism, the panel said, is merely a "figure of speech," because "in its literal sense synergism has never existed and never can exist in mechanical or hydraulic inventions . . . ."[125] As judicially defined, "synergism is simply too broad to provide a useful yardstick with which to measure patentability."[126] Second, the court saw that synergism was a test separate from nonobviousness, and Congress had established the latter standard. The third factor was the most critical: the synergism test actually prevents inquiry into nonobviousness. That result is inherent because synergism addresses the functioning of the device *after* the combination; section 103 looks to the obviousness of the invention *before* it was made. Because the statute expressly directs that a court's vantage point be "at the time the invention was made,"[127] synergism is an improper test.[128]

That is not to say that the Seventh Circuit advocated lowering the general standard of patentability. To the contrary, the court endorsed the results and "high standard" of *Anderson's-Black Rock, Inc. v. Pavement Salvage Co.*[129] and reiterated the need for close scrutiny of combination patents, based on *Great Atlantic & Pacific Tea Co. v.*

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[123] *Id.* at 970 n.20, 200 U.S.P.Q. at 777 n.20. The court had previously indicated the need for a synergistic result in, *inter alia, St. Regis Paper Co. v. Bemis Co.*, 549 F.2d 833, 838, 193 U.S.P.Q. 8, 11 (7th Cir.), *cert. denied,* 434 U.S. 833 (1977).

[124] 592 F.2d at 971, 200 U.S.P.Q. at 778.

[125] *Id.* at 970, 200 U.S.P.Q. at 777.

> The presence or absence of synergism proves little. Today, almost all mechanical devices consist of parts which interact with each other. This interaction has little, if anything to do with the required nonobviousness of the claimed invention. Although the absence of interaction may demonstrate the obviousness of the combination, the presence of interaction assuredly does not impart nonobviousness to a device clearly suggested by the prior art. *Id.*

[126] *Id.*

[127] 35 U.S.C. §103 (1976).

[128] 592 F.2d at 972, 200 U.S.P.Q. at 779. "Therefore until Congress shall otherwise legislate or the Supreme Court shall otherwise specifically hold, this court will continue to apply the *Graham* analysis as the exclusive means by which to measure nonobviousness under section 103." *Id.*

[129] 396 U.S. 57, 163 U.S.P.Q. 673 (1969).

Supermarket Equipment Co.[130] in approving terms.[131] What the court did was to emphasize that the analytic tools for applying that standard must be those mandated by Congress, applied in a manner reasonably calculated to provide clear and predictable decisions. Moreover, the court approved the results achieved in combination patent cases within the circuit, because it said that lower courts had really been applying the *Graham v. John Deere Co.* standard, implicitly or explicitly.[132]

Other circuits have been quick to note the force of the *Republic Industries* reasoning. The Tenth Circuit rejected altogether any requirement for a synergistic result in *Plastic Container Corp. v. Continental Plastics, Inc.*[133] The Second Circuit appears to have done the same, but not expressly. Reversing the district court's finding of in-

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[130] 340 U.S. 147, 87 U.S.P.Q. 303 (1950).

[131] 592 F.2d at 972, 200 U.S.P.Q. at 779.

[132] *Id.* at 971-72, 200 U.S.P.Q. at 779.

Succeeding cases in the Seventh Circuit have produced a mixed bag. On one hand, another panel of the Circuit entirely misconceived the thrust of *Republic Industries*. In *Dual Mfg. & Eng. Inc. v. Burris Indus., Inc.*, 619 F.2d 660, 205 U.S.P.Q. 1157 (7th Cir. 1980), the court purported to follow *Republic Industries*, but it failed to conduct the sort of detailed *Graham* analysis seen there. Instead, the court quoted extensively from *A&P*, said that *A&P* "laid down the dispositive test" for combinations, and applied that standard. The court did say,

> We hasten to add that we in no way mean to suggest that there cannot be an invention qualifying for patent status in a combination of old elements .... What we have here, however, is not a combination of various old elements such as screws, nuts, bolts, levers, cog wheels, and so forth, but very simply, the direct combination of two well-known mechanical procedures, both of which were in the prior art.

Id. at 665, 205 U.S.P.Q. at 1163. The court missed the essential foundation of *Republic Industries:* that section 103 requires inquiry into the obviousness of making the combination, not a determination whether the elements — or the procedures — were known. The *Dual* decision is more than a backward step; it bypasses synergism for a return to the epitome of the "invention" standard. One can only hope it is an aberration.

District courts, in contrast, have applied *Republic Industries* wholeheartedly. In *B&J Mfg. Co. v. Hennessey, Inc.*, 206 U.S.P.Q. 542 (N.D. Ill. 1979), the judge performed exactly the detailed *Graham* analysis the Circuit had mandated. *See also International Harvester Co. v. Deere & Co.*, 206 U.S.P.Q. 422 (C.D. Ill. 1979) (Following *Republic Industries*).

[133] 607 F.2d 885, 203 U.S.P.Q. 27 (10th Cir. 1979), *cert. denied*, 444 U.S. 1018 (1980). *Graham* "guidelines do not require that, for a combination of known elements to be nonobvious, the result achieved by the combination must be synergistic." *Id.* at 904, 203 U.S.P.Q. at 43. The court specifically overruled the suggestion to the

validity in *Champion Spark Plug Co. v. Gyromat Corp.*,[134] Judge Miller[135] noted the contention that the combination in question comprised old elements, each performing "the same function it had been known to perform," and that such combinations were not patentable under *Sakraida*. Although the court agreed with *Sakraida's* result, it said "we do not agree with what amounts to an oblique suggestion that the dicta in the Supreme Court's opinion overruled the statutory test of nonobviousness ... along with the analytical guidelines for that test established by the Court in *Graham*."[136] Judge Miller cited *Republic Industries* for the proposition just quoted, and in listing the criteria for nonobviousness, he did not include a synergistic result.[137] Therefore, it appears safe to say that the Second Circuit has rejected synergism sub silentio if not expressly.

Other courts have temporized. The Third Circuit overturned a district court's finding of validity in *Sims v. Mack Trucks, Inc.*,[138] but it relied upon the *Graham* test. The court specifically reserved judgment on the question whether a synergistic result is a "precondition to validity."[139] A panel of the Fifth Circuit, apparently unaware of the path taken by their brethren in *John Zink Co.*,[140] ducked the issue of synergism in *Huron Machine Products, Inc. v. A & E Warbern, Inc.*[141] That court admitted the existence of the synergism principle, but said "it does not aid this alleged infringer. The cited prior art could not be combined to produce the patent in suit."[142] The district court's *Graham* analysis was upheld. The District of Columbia Circuit similarly handled a patentee's attack on the district court's use of synergism to in-

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contrary it had earlier made in *True Temper Corp. v. CF&I Steel Corp.*, 601 F.2d 495, 202 U.S.P.Q. 412 (10th Cir. 1979) (*see* text accompanying note 105 *supra*). *Id.* at 904 n.47, 203 U.S.P.Q. at 43 n.47.

134 603 F.2d 361, 202 U.S.P.Q. 785 (2d Cir. 1979), *cert. denied,* 100 S. Ct. 1286 (1980).

135 Court of Customs and Patent Appeals, sitting by designation. *Id.* at 362, 202 U.S.P.Q. at 785.

136 *Id.* at 372, 202 U.S.P.Q. at 793

137 *Id.*

138 608 F.2d 87, 203 U.S.P.Q. 961 (3d Cir. 1979), *cert. denied,* 100 S. Ct. 1319 (1980).

139 *Id.* at 93, 203 U.S.P.Q. 967. The district court had found synergistic effect in the rearrangement of the components of a ready-mix cement truck so that the driver could observe the cement pour without leaving the cab. 459 F. Supp. 1198, 199 U.S.P.Q. 668 (E.D. Pa. 1978).

140 *See* note 119 *supra* and accompanying text. The cases were decided contemporaneously.

141 615 F.2d 222, 205 U.S.P.Q. 777 (5th Cir. 1980).

142 *Id.* at 224, 205 U.S.P.Q. at 778.

validate his patent in *Robintech, Inc. v. Chemidus Wavin Ltd.*[143] After passing reference to criticism of the test and to *Sakraida,* the court based its decision on the abundance of other material in the district court's opinion, so that "we could treat the synergism test as irrelevant and reach the same result."[144] These three courts recognize problems with the synergism test, but apparently do not wish to take a clear stand until forced to by concrete necessity.

In contrast, the Sixth Circuit rejected the form of synergism but retained the substance. Its opinion in *Smith v. ACME General Corp.*[145] reviewed the *Republic Industries* rationale favorably, but said that what the Supreme Court had meant by synergism was "a symbolic reminder of what constitutes nonobviousness when a combination patent is at issue," which "was not meant to reduce emphasis on the *Graham* analysis for obviousness...."[146] Rather than depend on a *Graham* analysis, however, the court proffered its own explanation of synergism, the requirement that a court isolate "that unique essence of the combination" to determine whether "that essence makes an authentic contribution to mankind's store of knowledge."[147] Notwithstanding its protestations about the primacy of *Graham,* the Sixth Circuit plainly relied on criteria as subjective as any considered under the "invention" rubric.[148] Thus, that court has retained the "unique essence" of synergism while admitting its "definitional deficiencies and theoretical flaws."[149]

Perhaps the most significant development occurred in the Ninth Circuit, however, in *Palmer v. Orthokinetics, Inc.*[150] The district court had invalidated a patent for a wheelchair designed to permit children to be carried easily in automobiles. That rationale was grounded in the patentee's failure to produce a synergistic result, defined in terms of

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143 205 U.S.P.Q. 873 (D.C. Cir. 1980).

144 *Id.* at 875-76.

145 614 F.2d 1086, 204 U.S.P.Q. 1066 (6th Cir. 1980).

146 *Id.* at 1095, 204 U.S.P.Q. at 1069.

147 *Id.* The court defined synergism: "When confronted with a combination patent this standard requires an isolation of that unique essence of the combination and a determination of whether that essence makes an authentic contribution to mankind's store of knowledge." *Id.*

148 *Cf.* note 9 *supra* (*Ortmayer:* "that impalpable something").

149 *Cf. Skil Corp. v. Lucerne,* 206 U.S.P.Q. 792 (N.D. Ohio 1980). Evidently not yet apprised of the Circuit's holding, this district court mentioned synergism in passing as the applicable test, but applied a nonobviousness analysis, relying heavily on "secondary considerations." *ACME General* was not mentioned.

150 611 F.2d 316, 204 U.S.P.Q. 893 (9th Cir. 1980).

"expected" result.[151] The circuit court sharply criticized the district court's failure to perform a *Graham* analysis, saying that "[t]he conclusory statements in the memorandum of decision concerning 'synergism' are inadequate to enable this court to determine whether the district court properly considered the critical question posed by §103."[152] The court noted approvingly the "well reasoned opinion" in *Republic Industries* but did not reject the synergism test altogether.[153] Unlike the Sixth Circuit, however, *Palmer* leaves the synergism test an empty shell. The Sixth Circuit, for all its purported emphasis on *Graham,* returned in the end to a subjective analysis of "invention," continuing rather than alleviating the confusion.[154] In contrast, the Ninth Circuit said that the only test is nonobviousness, and that test must be applied from the point of view of the prior art "at the time the invention was made."[155] Such analysis practically precludes a synergism test, which inherently looks at the combination after the fact.[156] De facto, synergism is dead in the Ninth Circuit, but the Sixth Circuit must go through a period of confusion with a new definition before it can return to the *Graham* standard.

VI. CONCLUSION

Taken together, *Republic Industries* and *Palmer* constitute a breakthrough in the analysis of combination patents. The former decision provides the analytical rationale for abandoning the unworkable and confusing concept of synergism as a patent standard. The latter demonstrates how to substitute the *Graham* standard to uphold a patent on a mechanical combination.[157] Comparison of factual situations will

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[151] 197 U.S.P.Q. 207 (C.D. Cal. 1977), *rev'd,* 611 F.2d 316, 204 U.S.P.Q. 893 (9th Cir. 1980).

[152] 611 F.2d at 324, 204 U.S.P.Q. at 900.

[153] *Id.* at 324 n.17, 204 U.S.P.Q. at 900 n.17. "Without rejecting the 'synergism test' we conclude that a Graham analysis is necessary in this case." *Id.*

[154] *See* note 143 *supra.*

[155] 611 F.2d at 324, 204 U.S.P.Q. at 900.

[156] *See* notes 100-02 *supra* and accompanying text.

[157] *But see Ballas Liquidating Co. v. Allied Indus. of Kansas, Inc.,* 205 U.S.P.Q. 331 (D. Kan. 1979). The court attempted to reconcile *Graham, Sakraida, Reinke Mfg.* (8th Cir. precedent; *see* note 103 *supra* and accompanying text), and *Republic Industries.* The decision treated synergism as a test on par with "secondary considerations" and looked for a causal link between the claimed synergistic result and the patent claims. Finding none, the court said, "the synergistic result, if any, is insufficient to overcome the obviousness of the invention." *Id.* at 349. Evidently, some time and light will be needed before the synergistic fog dissipates.

give district courts and the patent bar valuable guidelines on the showing a patentee must make to prove that his invention meets the standard of patentability set by section 103.

A current running below the surface in the synergism debate has been the extent to which "secondary considerations"[158] affect the determination of nonobviousness. That question has been a subissue in many cases, but the debate has been focused even less clearly than the synergism controversy.[159] One explanation for this lack of focus is that courts have settled close cases of nonobviousness by falling back on synergism; the very lack of precision, like "invention" before it, made synergism an attractive substitute for hard analysis. The absence of direction from the Supreme Court — secondary considerations seemed out of favor, yet never had been expressly rejected[160] — probably contributed to courts' hesitation to employ them.

The return to *Graham* means a return to factual determinations, determinations that often are very close decisions.[161] Such decisions are exactly the cases in which resort to Judge Hand's "sign posts" are most helpful.[162] Moreover, as the *Graham* Court pointed out, those "subtests" are "more susceptible of judicial treatment than are the

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158 *See* notes 52, 37 *supra* and accompanying text.

159 *Compare Speed Shore Corp. v. Denda,* 605 F.2d 469, 203 U.S.P.Q. 807 (9th Cir. 1979) (because facts were close and *Graham* allowed "secondary considerations" to play a part in such cases, the court applied those factors and validated the patent) *with Sims v. Mack Trucks, Inc.,* 608 F.2d 87, 203 U.S.P.Q. 961 (3rd Cir. 1979) (although facts were close, court looked at them "through *Sakraida* eyes," and did not apply such subtests).

160 The Courts in both *Black Rock* and *Sakraida* gave such short shrift to the patents in question that they found no need to consider the secondary factors, dismissing them with a wave of *A&P* language. Such considerations, they said, "without invention will not make patentability." *Sakraida,* 425 U.S. at 282, 189 U.S.P.Q. at 452; *Black Rock,* 396 U.S. at 61, 163 U.S.P.Q. at 674, *citing A&P,* 340 U.S. at 153, 87 U.S.P.Q. at 306. On the other hand, the Court never has rejected use of the factors, and the *Graham* opinion spoke of them approvingly. 383 U.S. at 17-18, 148 U.S.P.Q. at 467. *See* note 42 *supra.*

For an excellent picture of the quandry these conflicting signals have created for lower courts, see *Brennan v. Mr. Hangar, Inc.,* 203 U.S.P.Q. 697, 702-05 (S.D.N.Y. 1979 (Conner, J.).

161 *See, e.g., Photo Elec. Corp. v. England, 581* F.2d 772, 199 U.S.P.Q. 721 (9th Cir. 1978) (complex technical facts); *Lerner v. Child Guidance Prods., Inc.,* 406 F. Supp. 560, 565, 189 U.S.P.Q. 83, 87-88 (S.D.N.Y. 1975) ("virtually always" a close question) (Conner, J.).

162 *See* Rich, *supra* note 67, at 406. *See also Sarkisian v. Winn-Proof Corp.,* 203 U.S.P.Q. 60, 66 (D. Or. 1978) (tests "especially helpful").

highly technical facts often present in patent litigation."[163] The *Palmer* court noted the closeness of the technical facts in that case and specifically directed the district court to make findings on the "secondary considerations" on remand.[164] Without abandoning the guidance that such secondary indicia should not "tip the balance,"[165] courts should recognize that in many cases the question of nonobviousness is so close that decision based solely on the prior art amounts to "nothing more than the substitution of its judgment for that of the Patent Office."[166]

Rejection of synergism will not usher in the millenium for the patent bar. Courts are unlikely to disturb the high standard of patentability, and, as the *Republic Industries* court observed, courts have most likely been applying the right general standard anyway, regardless of the confused rationale.[167] But clarification of reasoning is a goal well worth achieving in terms of predictability of result and analysis of decisions. Furthermore, the discussion of "secondary considerations" can resume, with the probability of their increasing use. The confusion wrought by the careless introduction of "synergism," however, is a lesson that should have been learned before now. Judge Cardozo warned a half-century ago: "Metaphors in law are to be narrowly watched, for starting as devices to liberate thought, they end often by enslaving it."[168]

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[163] 383 U.S. at 17-18, 148 U.S.P.Q. at 467.

[164] 611 F.2d at 325, 204 U.S.P.Q. at 901.

[165] *Dennison Mfg. Co. v. Ben Clements & Sons,* 203 U.S.P.Q. 895, 915 (S.D.N.Y. 1979), *citing A&P,* 340 U.S. at 153, 87 U.S.P.Q. at 306.

[166] *Brennan v. Mr. Hangar, Inc.,* 203 U.S.P.Q. 697, 705 (S.D.N.Y. 1979) (Conner, J.) ("This court would not shrink from such a substitution if it had a firm conviction of the obviousness of the invention, but it does not").

[167] *See* text accompanying note 132 *supra.*

[168] *Berkey v. Third Ave. Ry. Co.,* 244 N.Y. 84, 94, 155 N.E. 58, 61 (1926) (Cardozo, J.).

THE RELATIONSHIP BETWEEN LAW AND SCIENCE*

HUGH GIBBONS**

It is the fate of those upon whom fall fame and fortune that the rest of us become terribly interested in what they are doing. Not too long ago the scientist in his laboratory and the engineer at his drafting table were of interest only to the occasional advertising executive looking for an appealing subject for a Scotch ad. That has changed in the past two decades. Science and technology have become the focus of great interest. A number of research centers have been formed to look into the relationship between science and social change and between science and human values. Technology assessment and science policy have become formal areas of study. And a "low-technology" movement has arisen, questioning whether further technological development is "progress."

Law/science is part of this movement. It arises from the awareness that most of the burning problems that the law copes with have, at their root, technological change. We assumed that we had a right to the parts of our body, to the clouds overhead, to the pond in our backyard. But then came the technology of organ transplantation, of cloud seeding and of ecology, and those rights are not at all clear.[1]

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*The research and ideas set forth in this paper were developed in the course of two seminars. The author would like to thank Susan Bodine, E. James Hamilton, Robert M. Marden, Gary Molnar and David J. Mullett, who participated in 1979, and J.D. Bernardy, Thomas J. Monahan and David N. Sandberg, who participated in 1980, for their generosity of spirit and thought.

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[1] The court in *Strunk* v. *Strunk,* 445 S.W.2d 145 (Ky. 1969), for example, ordered that a kidney be removed from a 27 year old institutionalized mental incompetent for donation to his brother who was suffering from fatal kidney disease. Following *Strunk,* a Texas court ordered the transplantation of a kidney from a 14 year old girl with Down's Syndrome to her brother. *Little v. Little,* 576 S.W.2d 493 (Tex. Civ. App. 1979). No court has yet ordered donation by a competent adult.

Science and technology change not only the substance of law but also its process. The drunkometer shoulders a large part of the burden of proving that a driver was intoxicated; some argue that lie detection technology would more effectively distinguish the guilty from the innocent than a trial; computers change legal research and judicial administration.[2] Are these changes for the best? The law must make its own assessment of technology.

The relationship between law and science is not all in the direction of science's impact on law. The law impacts upon science and technology as well. In the conventional wisdom, law is the saddle upon which humans ride society and the bridle that they use to direct change. Does law ride technology? Does it direct technological change? Should it?

The relationship between law and science is complex and reflexive. It is also unclear. It is the purpose of this paper to clarify it, to provide a conceptual framework within which these two huge human undertakings can be understood to relate to each other.

Before we begin, I would like to give a little background on the origins of the project. From its inception in 1973, Franklin Pierce Law Center has concentrated its efforts upon those areas of the law that touch upon science. This produced active programs in patent and intellectual property law, in regulatory law as it hit upon such things as toxic wastes and food additives, and in environmental and energy law. To one like myself, however, who came to the Law Center with no more scientific background than a little economics, it was not clear what this concentration was about, beyond the fact that all of the efforts had something to do with physics, chemistry and biology. To the outsider, law/science was atomized into arcane specialties. Yet we outsiders constantly found ourselves bumping into science and technology, grappling with electronic eavesdropping in Criminal Law, amniocentesis in Torts and electronic funds transfer in Commercial Law.

Several of us began to grope for a way to understand law/science in a large enough framework so that we could talk to each other about it and learn from each other's perspectives and experience. We began by gathering a body of law/science books and articles and discussing them. That literature is summarized in Part I of this paper. We begin with it for two reasons. First, there is no survey of the literature presently available. To a great extent, the literature consists only of concerns, concerns of scientists that law is out to get them and concerns of lawyers that scientists are changing things often for the worst. The

[2] An excellent collection of information about electronic technology presently available to the practicing lawyer is provided by Gara & Naegeli, *Technological Changes and the Law – A Reader,* (1980).

literature is surprisingly vituperative. I have tried to avoid the vituperation in what follows, to get to the heart of the honest concerns of lawyers and scientists about each other, but a little of it sneaks through.

The second reason to begin with a survey of the problems is that that seems to be the most effective way to grasp your attention and form a common basis for the theorizing that follows in Parts II, III and IV. Part I sets forth seventeen different problems in the law/science relationship. If you are a lawyer who has been concerned by the effect of technological change or a scientist concerned by the effect of law, you should recognize very quickly at least two or three of the problems. At the same time, you will be able to see what bothers others and why that is so. An overview of the breadth and depth of the law/science problem should give you a feeling for what is at stake in the theorizing that follows.

In Part II of this paper I will set out six different paradigms that relate law and science to each other in a dynamic way. That is the physiology of the law/science relationship. In Part III we take up its anatomy, surveying the areas in which law and science touch upon each other and organizing them into a taxonomy. (In science, one generally takes up anatomy before physiology, but this is law and certain allowances have to be made.) In Part IV we will consider a number of solutions that have been proposed in the literature to the law/science "problem." These solutions are not particularly interesting as such, for it is dangerous to treat a patient before his anatomy and physiology is understood, and Parts II and III are just an initial stab in this direction. But the solutions are revealing of the relationship, of the deep concerns that many thoughtful people have about the role of both science and law in this society. Some of the solutions are quite startling, even revolutionary. They bring home to us the fact that, under the fog that has shrouded the relationship between law and science, lie some very basic questions about the direction of our civilization.

PART I. The Law/Science Problem

Concern about the relationship between law and science organizes itself under three main themes. First, law[3] has placed unnecessary

[3] For the purpose of this paper, we will take "law" to mean that set of institutions which direct the use of coercion in society. One of those institutions is "laws" — the statements made about how coercion will be used (e.g., "Anyone convicted of burglary will be sentenced to not more than ten years in prison."). Other legal institutions include the organizations that enforce laws. Law is one member of a set of institutions of social control. Law is distinguished from the other members of the

constraints upon science[4] and technology[5] by failing to keep pace with their developments. Second, science and technology have radically changed society often for the worse, and law must be used to control it. Both of these views are normative, in the sense that their proponents see something wrong with the world (i.e., too little or too much science and technology) and would use law to make it what it ought to be. The third theme is descriptive: Science and technology have made basic changes in the law; we must study them and determine whether or not they are good. We will take up the various propositions in that order. The first three propositions are part of the first theme. The next three relate to the second theme. And the last eleven develop the third theme.

Law is stifling science and technology.[6]

Law provides the social context for the pursuit of science and technology, just as it provides the context for all behavior. Laws may favor behavior[7] or inhibit it. The patent system, designed to promote technology by giving inventors a special property right in their ideas, has weakened. Patents have become expensive to obtain and almost

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set (e.g., norms, mores, folkways, etc.) by the fact that only laws are enforceable by the systematic coercive power of the state.

[4] "Science" refers to the process of making descriptive statements about the world within the strictures of the scientific method.

[5] "Technology" refers to the process of altering behavior to achieve new ends or to achieve existing ends more efficiently. Technology may be embodied simply in the human mind ("know-how;" "technique") or in things ("hard" technology) which, when directed by human effort, achieve an objective. Technology *may* emerge from science: a fuller or more accurate statement of reality may lead to a more effective product of process. But technology may emerge as well from other sources such as the insight of the inventor who is completely unschooled in science. Historically, science has resulted more from technology ("Why does the wheel work?") than technology from science. In the past two centuries, however, technology has become closely bonded to science, ever more quickly transforming more powerful descriptions into more powerful processes.

[6] Scientists are quick to point out that law is a potent weapon in the hands of the misdirected (Margolis, *From Washington: The Politics of Floridation,* 10 Bull. of the Atom. Scientists 38 (June 1964)), that science and technology are under stringent nonlegal controls, such as the market, peer criticism and university controls (Dubridge, *The Social Control of Science,* 25 Bull. of the Atom. Scientists 26 (May 1969)), and that, because of excessive constraints in this country, technological leadership is passing to other countries (Holden, *Innovation: Japan Races Ahead as U.S. Falters,* 210 Science 751 (1980)).

[7] Gordon Brewster Baldwin provides an inventory of the ways in which law is used to support science and technology in, *Law in Support of Science: Legal Control of Basic Research Resources,* 54 Geo. L.J. 559-592 (1966).

impossible to defend. Inventors are increasingly keeping their ideas to themselves, not making them public through the patent system, thereby diminishing the free flow of information that is essential to vigorous science and technology.

The weakening of the patent system is only the tip of the iceberg. Technological advance is thwarted by excessive product liability rules that make manufacturers reluctant to improve their products for fear of unforeseen liability, by overcautious regulation of innovation such as the Food and Drug Administration's control of new drugs and food additives, and by direct regulation of scientific investigation itself, as with the National Institutes of Health's controls on genetic research. Part of this problem stems from the fact that

Lawyers and scientists can't talk to each other.[8]

Lawyers don't understand the scientific process and, as a result, are suspicious of it.[9] Where lawyers think in terms of guilt and innocence, sanity and insanity, and right and wrong, scientists think in probabilities, trends and tendencies, forces and parameters. Lawyers want answers that scientists can't give: Is this drug safe? Was that defendant sane? Is this market competitive? Lawyers have a commitment to the status quo, to orderly, controlled change, while scientists follow change at top speed wherever it leads, and they expect society to follow them. The lawyer views medical and psychological experimentation on humans as a threat to human dignity while the scientist views them as essential to understanding human nature — and he may view the idea of human dignity as a mystical fabrication that has outlived its usefulness.[10]

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[8] John Hersey (*The Triumph of Numbers,* Atlantic 78-84 (Oct. 1980) talks of the widening gulf between the world of words and the world of numbers. Laurence Cranberg (*Science, Ethics and Law,* Zygon 262 (Sept. 1967)) characterizes it as a gulf between the world of values and the world of facts. Lawyers and scientists have made an effort to span the gulf with conferences, such as the one reported in *AALS/AAAS Joint Panel Discussion on the Law – Science Interface.* 16 Jurimetrics J. 24 (1975). If these reports are accurate, the gulf is wider than might have been imagined. Thomas Field has urged law schools to close the communications gap by training lawyers in science concepts in *Science, Law and Public Policy: Meeting the need in Legal Education;* 13 New England L. Rev. 214 (1977).

[9] Lee Loevinger (*Law and Science as Rival Systems,* 8 Jurimetrics J. 63 (1967)) argues that it is time for lawyers to learn the data gathering and analysis methods of science. By incorporating the empirical method of science into the dialetical method of law, the fact finding processes of law will be improved.

[10] In *Beyond Freedom and Dignity,* (1971), B.F. Skinner argues that it is now possible to design society intentionally through the use of technology of behavior. Senti-

It is not clear whether the difference between lawyers and scientists is a difference in style of thought or in values, but it is clear — at least to some scientists — that lawyers hold the power in the society and that they are not using it to favor science and technology. Scientists are particularly troubled by talk of controls on basic research. Lawyers spend most of their time helping people avoid potential harms and redressing harms once they have occurred. What happens when we realize that ideas can hurt? Scientific research into racial and sexual differences, into the basis for social class differences, and into the genetic basis of intelligence may well provide ideas that hurt. Shouldn't harm be avoided by slamming the door on such research? How do we resolve the conflict between the lawyer's faith that all people are equal before the law and the scientist's demonstration that, in every other way, they aren't equal? Lawyers and scientists do talk to each other, but they often do not have nice things to say.

The conflict between legal and scientific attitudes may be more apparent than real. Is it not true that lawyers are themselves engineers, changing the rules of society through judicial opinions, legislation and regulation to help society adapt to changes of circumstance and to new opportunities? In this view:

> **Law should be used positively to adapt society to technological and scientific changes. The problem is that lawyers don't see themselves as innovators, assertively changing law to fit society to new realities.**

Under this view, technological innovations create a demand for social innovation — the modification of social organization to capitalize on that innovation.[11] One form of social innovation is legal innovation. The advent of a new technology requires that laws be changed to fit the technology into society. The introduction of the automobile, for instance, resulted in great legal innovation — traffic laws, licensing laws, insurance laws. But this process was hit or miss, taking decades

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ments named freedom and dignity stand in the way of the successful redesign of society and should be relinquished. Science, in this case, gives rise to very forceful normative prescriptions.

[11] This idea was presented by Harvey Brooks in a speech at Franklin Pierce Law Center on Nov. 21, 1980. He predicted that social innovators (e.g., marketing experts, financial managers, government policy makers and perhaps lawyers) would be more closely and systematically tied to innovators in "hard" technology in the future so that the adoption of a new technology by society would be smoother and less disruptive.

to adjust society to the new harms and opportunities of the automobile. If the law had seen itself as an adaptive mechanism, studying the legal changes necessitated by the automobile and assertively implementing them, there would have been a great saving in frustration, uncompensated injuries and dissatisfaction with the automobile. But lawyers don't see themselves as innovators. Legal education is outmoded. Lawyers should be trained as engineers are trained to look for opportunities for change, to understand scientific information and to act positively to adapt the rules to new realities.

Under this view, law is itself a form of technology — lawyers are engineers who wear suits. But this assumes that all scientific change is for the best, that adapting society to technological change is the thing to do. That brings us up against the second theme:

> **Things are in the saddle riding man. It is time for man to exert control through law.**[12]

There is a version of this theme, which we might term the neo-Luddite view, that doesn't involve the law at all. It urges direct action against those aspects of science that are evil: refusing to use tax money to pay for genetic research; setting loose bacteria that eat silicon in computer centers; refusing to fill in the blanks on personality tests. Advocates of this position share the view that:

> **Science and technology have a life of their own, a driving force that is unattached to human values.**[13]

There are many versions of this theme, but a familiar one[14] is that technology, particularly after it was linked with science in the last century, drove a self-destructive form of industrialization. Population and standard of living rose explosively, destabilizing nations by

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[12] Any number of ways for exerting law over technology — most of them pretty extravagant to the lawyer's ear — have been proposed. Wilber Terry, for example, has argued that the Constitution addressed the age when tyranny at the hands of kings was the danger and that it is no guide to avoiding the tyranny of technology. A complete rethinking of the Constitution is required (*Must We Rewrite the Constitution to Control Technology?* Saturday Review, 50-54 (March 2, 1968)). Bertrand de Jouvenal suggests the formation of a "surmising forum" of thoughtful private individuals who would consider the various possibilities for the future and derive a science/technology policy from the path deemed most attractive. *(Letter From France – the Technocratic Age,* 20 Bull. of the Atom. Scientists 27 (Oct. 1964)).

[13] This proposition is made by a number of writers (e.g., R.S. Morison, *Science and Social Attitudes,* 165 Science 150 (July 11, 1969)), and will be developed more fully in Part II of this paper.

[14] Donella H. Meadows, *et. al., The Limits to Growth,* (1972).

unrealistically raising expectations, resulting in political and legal disorder. Now, after barely one hundred fifty years, our natural resources are on the brink of exhaustion, our societies in disarray, we must return to science for a "technological fix" to the problem. Technology creates our troubles and simultaneously makes of itself the only solution to those troubles, a solution that will surely lead to a continuing need for more technology. We blow apart the ideals of family, community, harmony with the environment, individual dignity and responsibility.[15] The fatal irony is that we give up control to a process that was supposed to give us control over our fate.

In this view, the critical task of post-industrial society is to assert human values to control science and technology and the massive organizations they have formed. Law is one way in which values control social behavior. It is not surprising, then, that many writers point to the law as the way of reconnecting human values to science and technology.[16] But there is a serious problem here:

> **We do not know how to use law to control science and technology. What is needed is reseach into the way that law controls behavior and a measure of its effectiveness in doing so.[17]**

There is an irony here, for what is needed under this view is for law to become more scientific and technological about itself so that it can control science and technology. Judges, legislators and lawyers have

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[15] Leading examples of the growing literature expressing this view are Jacques Ellul's *The Technological Society,* Lewis Yablonsky's *Robopaths,* and E.F. Schumachaer's *Small Is Beautiful.* J.J. Gordon and A.L. Shef have devised an index of technological development that they call "technological status," combining the measures of power production, steel production, transportation, communications and number of scientists and engineers per capita. It is their conclusion that the technological status of the world doubles every twenty years. (*National Programs and the Progress of Technological Societies,* 15 J. Astronautical Sci. 231 (Sept./Oct. 1968)).

[16] *See,* Wheeler, *Bringing Science Under Control,* 2 Center Magazine 59 (March 1969).

[17] Something broader than jurimetrics is required. Lasswell and McDougal call for the development of a theory *about* law. Theories *of* law, describing the basis for substantive decisions, are too narrow in that they fail to describe the function of law in the allocation of values. (*Criteria for a Theory About Law,* 44 So. Cal. L. Rev. 362 (1971)). In the decade since that article there has been considerable action on that front — by social scientists. Economists have provided a very well-developed theory about law (*see* Posner, *Economic Analysis of Law* (2d ed. 1972)). And sociologists have shown some interest (*see* Black, *The Behavior of Law* (1976)). Gray L. Dorsey looks upon computers as the critical ingredient in understanding law well enough to use it for the control of technology. (*Computers From the Perspective of Social Philosophy,* Wash.U.L.Q. 372-540 (1977)).

a great, and unwarranted, faith in the power of edict. When the National Science Foundation gives $250,000 to a scientist to compare the effect of various rat poisons on rat deaths we assume that that will be studied. When a judge adopts a tough product liability standard, he assumes that products will get safer. But is that what happens? Does the rat researcher spend most of his money to study rats or to develop new subjects for future research grants? Does the manufacturer just spend more money to hire a better law firm to defend it in future product liability cases?

Technology is very good at controlling things because, with the aid of science, it understands the dynamics of what it would control. Where it doesn't — the case of macroeconomists trying to fine-tune the monetary system springs to mind — the result is pitiful or worse. The trouble with law as a controller of science and technology is that their dynamics are not understood. The common law cut its teeth on controlling social behavior that was obvious to everyone — providing for the orderly transfer of property at death, getting drivers to drive on one side of the road, keeping the police from doing worse crimes than the ones that they were meant to control. Were science and technology to show up in court or before a legislature wearing a devil's outfit and wielding a wand of power, they would be easy for the law to sink its teeth into. But they don't. They come in the form of perfectly nice people telling a tiny part of a story that is terribly complex and apparently innocuous.

We are moving now into the third theme of law/science problem:

> **Science and technology have wrought fundamental changes in the law that are not understood and were never chosen.**[18]

If one were serious about the last theme (that law should be used to control science and technology) one would be chastened not only by the realization that it is not clear how that would be done but also by the fact that the controller (law) is, to some extent, under the control of that which it would control (science and technology). It is not possible to give a complete description of that process, but the literature does enable us to point to certain of its elements.

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[18] A.S. Miller examines the causal linkage between scientific discovery, technological development, social change and, finally, legal change, in *Technology, Social Change and the Constitution,* 33 Geo. Wash. L. Rev. 17 (1964). Law is traditionally at the end of that causal chain, not the beginning, where those who would use law to control science and technology would have it.

Technological development increases the amount of the world that is under intentional control, thereby increasing the amount of power in a society and putting pressure on its decision-making process.

Technological development transforms authoritarian states into totalitarian states. Henry VIII was not a nice person, but the damage that he could do was constrained by the technological innocence of his time. Hitler was not a nice person either, but his evil was magnified by the information and military technology under his power to global proportions. The problem is no less real in democratic societies. Technological development expands the power of each person to affect others. Decisions exist that once were not possible, such as the choice of tne sex of one's offspring or the path of one's aircraft. And the impact of one's decisions upon others is increased.

There are two results of this increased load of decisions. First, decision-making becomes formalized. The form is law. Law reaches more deeply into private life. Second, there is a shift from less to more economical forms of decision. At first this is a shift from adjudication to statute, then from statute to regulation, so that today the vast bulk of laws emanate from administrative agencies. It becomes ever more important to head off dangers before they arise than to let them happen and then adjudicate.

This effect is augmented by the fact that:

Advances in scientific knowledge increase our understanding of the effect of decisions. Decisions that were once considered innocuous are now seen to have consequences that justify the intervention of law.

Where once it was thought harmless to clear a swamp in your yard, today it is clear that you are affecting the water recharge cycle, perhaps harming everyone in town. The result of this knowledge is wetland acts that control land use decisions affecting water. Land use controls, product and occupational safety regulations, automobile design controls, the Endangered Species Act, and so on, proliferate as our understanding of cause and effect rises.

Expanding knowledge drives law into previously unchartered waters. It has, for example, always been illegal for parents to have sexual relations with their children and for them to injure their children. But those offenses were rarely prosecuted. They occurred within the family or neighborhood and were handled, if at all, informally by personal mediation. That has begun to change. Psychologists have documented the evil effects of incest and physical abuse upon the

child's life, making it difficult to shrug them off. Survey researchers have shown that they occur with shocking frequency. And the nearly universal use of the hospital emergency room to treat serious injuries has given us a way of identifying likely violations and getting the law into action. The family doctor, who would sweep incest and abuse under the rug, has been replaced by the emergency room doctor who feels no personal allegiance to the family. Here, as elsewhere, science and technology have animated laws that were once only pieties.

Scientific advance and technological development have increased not only the number of decisions to be made and the magnitude of those decisions but also the complexity of decisions. The case of antitrust enforcement is illustrative. The Sherman Act forbade monopolizing and conspiring to restrain trade and, during the first half of this century, that was what lawyers looked for. They searched for evidence of clandestine meetings in hotel rooms where competitors met to set prices over a bottle of bourbon and a box of good cigars. They looked for industries dominated by a large firm whose actions were "predatory." But then came microeconomics and econometrics, experts in industrial organization and statistical analysis, new concepts of efficiency and cross-elasticity of demand. Where once the lawyer looked for evidence of secret meetings, today he looks for an economist who is willing to infer monopoly from reams of statistical information. Even the smallest antitrust case generates a record of thousands of pages and involves numerous experts. The experts act as an aid to the court in evaluating the mountain of material they have placed before it.

Antitrust cases are more complex than most, but they are by no means unique. Any case involving a product, such as an airplane crash, will generate volumes of engineering data. And any case involving a large-scale project, such as the review of a license to build a nuclear power plant, will generate a technical record which the court simply cannot digest.

> **The judicial process was designed for a simpler age, when the facts in dispute arose out of daily life and were easily understood by the amateur. It is not adequate to the resolution of highly complex questions.[19]**

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[19] This awareness surfaces frequently in judicial review of the decisions of administrative agencies. In *International Harvester Co.* v. *Ruckelshaus,* 478 F.2d 615, 648 (D.C. Cir. 1973), the court put it this way: "A court's role on judicial review embraces that of a constructive cooperation with the agency involved in the furtherance of the public interest." One hears little of "constructive cooperation" when a

Courts have struggled mightly against this conclusion. They have been willing to listen endlessly to experts, to struggle with data that would tax a PhD candidate in the field, to study complex subjects on their own. Any number of changes in the judicial process have been suggested to adapt it to complexity: a specialized science court to make findings in technical cases; science experts to serve as clerks to judges; a data base of science information that is available to judges; scientists who are advisers to the court.[20] But even with these changes, power and would have slipped from the court to the experts who provided opinions.

Courts are not the only ones afflicted by technical complexity:

> **Power has shifted out of the hands of the generalist into the hands of the specialist. Judges, legislators, generals, business managers,[21] are being replaced by the technocrats who run administrative agencies, consulting firms, computerized information centers.[22]**

In this view, the shift of power out of courts and legislatures is simply part of a far larger shift of power into the hands of technocrats.[23] This is partly because amateurs are intimidated by experts and partly because the danger of a poorly-based decision seems greater than it once did. The dangers of a poorly designed or misplaced nuclear power plant are so huge that both court and legislature will defer to the experts. Once the experts have spoken it will be very difficult for a court to examine their conclusions. Even where a court applies a "hard look"[24] review of that decision, it will be looking hard only at the process by which the decision is made and not at its substance.

The shift of power to a science/technical elite raises serious ques-

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court reviews the actions of the police force, but in complex technological areas the court has no alternative.

[20] Leventhal, *Environmental Decisionmaking and the Role of the Courts,* 122 U.Pa.L. Rev. 509 (1974).

[21] In high technology industries control has shifted from management to technician. Management has become a ticklish business, generating a literature of its own (*see,* Arrow, *"Control in Large Organizations,"* 10 Management Sci. 397 (April 1964) and Galbraith, *The New Industrial State*).

[22] A.S. Miller examines this process in *Science Challenges Law,* 13 *Amer. Behavioral Scientist* 585 (April 1970).

[23] King, *Whither the Technological State,* LXV Pol. Sci. Q 55 (March 1950).

[24] Leventhal, *supra* note 20.

tions about the democraticness of society,[25] about the relevance of the constitutional scheme for balancing power. Where the power that we are talking about is the power to make law itself, and not simply the power to make decisions that affect others, those questions are especially severe. In theory, it should be possible for the institutions of law — court, legislature, lawyer — to turn over their descriptive functions to scientists and technologists while still retaining their normative functions, their judgment as to whether a particular set of facts is desirable. But in practice this is difficult. Experts, like everyone else, have their own preferences and those preferences infect their view of the world. The nuclear scientists who work for the power companies, nuclear engineering firms and nuclear regulatory agencies are, on average, far more bullish on the future of nuclear power than the rest of us. Is that because they have seen something that is opaque to us? Or because they got into that line of work because they liked nuclear power to begin with? Or because their jobs are on the line? How can we tell? Similarly, ecologists take the situation of nature more seriously than most of us, to the point of asserting that inanimate things have "rights". Is it because of something that has been revealed to them or is it a matter of personal values?

Nuclear engineers and ecologists are today providers of law. They shape and draft regulations, draft the legislation that is enacted into law, testify in cases at law. Their descriptive contributions are essential, for they are the ones who understand how the world works. But how much of their normative attitudes is made law? Are scientists and engineers, as some have claimed,[26] the new aristocrats who would decide for the rest of us what is for the best?

Thus far we have been concerned with the descriptive affect of science upon law, the weakening of traditional legal institutions in the face of the increased number, magnitude and complexity of decisions. Scientific advance confronts law with some directly normative challenges as well.

Every technological development requires the law to define the set of rights that will control it.

Let us take a simple example. At common law, the owner of a piece of land owned the space above the land *ad coelum* — all the way to

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[25] Daddario, *Technology and the Democratic Process,* LXII Tech. Rev. 18 (July-Aug. 1971).

[26] Green, *The Risk-Benefit Calculus in Safety Determinations,* 43 Geo. Wash. L. Rev. 791 (1975).

heaven. With the advent of the airplane it became necessary to rethink that right. If the courts had stuck with it, everyone who flew an airplane would have had to negotiate with everyone whose space he flew through, an impossible task. So the court destroyed the old right to property *ad coelum,* giving the airplane pilot the right to fly wherever he wanted, so long as he conformed to the regulations of the Federal Aviation Administration (the creation of the FAA and the grant to it of power to control air traffic is part of the shift of power from court and legislature to administrative agency noted above).

The process of defining and redefining rights is not a "problem." That is what the law is *for.* The problem arises for two additional reasons.

The pace of technological change is too rapid for the normal evolutionary processes of the law to work well.

The law does not assign rights out of a process of divine revelation. It assigns rights, sees how they work, checks to see how a different set of rights worked in another jurisdiction and modifies the assignment of rights accordingly. At common law this was a judicial process, one court adopting one rule, another court adopting another. Should the possibility of reverter be alienable? After four hundred years it became clear that it should.

But the increasing pace of change threatened to make this process incoherent, so the assignment of rights passed to legislatures, which could act more quickly and provide uniformity throughout a state. Still, different states adopted different rules, so it was possible for them to learn from each other. During very rapid change, however, this process also becomes incoherent. Increasingly, the federal government has become the source of new rights and uniform laws. The laws that govern the new technologies — communications, transportation, pharmaceuticals, and so on — emanate from Washington, D.C. More significantly, those laws do not create substantive rights. They create procedural rights but leave the substantive decision to the discretion of an administrative agency. Rights are replaced by policies.

The effect of the centralization of decisions and the shift from substantive to procedural rights has been to weaken the evolutionary process of law. The rights approach furnished a feedback mechanism for collective decisions. The initial decision (i.e., a judge-made rule of law or a statute) would create both rights and, shortly thereafter, a column of plaintiffs making claims under those rights. The court could see, on a case-by-case basis how the rights were working out and modify them in the light of experience. Without such a feedback

system the initial collective action must be very accurate indeed. With the centralization of decisions, all eggs go into one basket. Without a strong discipline of substantive rights, the one who holds the basket must be very sure that he is acting correctly before he whirls it around his head.

The second source of difficulty with formulating new rights is that:

> **We lack adequate guidance for shaping new rights. Much new technology creates problems for which the Constitution and precedent offer weak guidance.**[27]

As science and technology create ever more powerful tools for modifying the environment, they make past experience an inadequate guide for future rights. Consider amniocentesis. It is the process by which the fetus may be tested *in situ* to determine whether it has certain chromosomal and metabolic disorders. If it is defective, it may be destroyed by abortion. The rights questions presented by amniocentesis are breathtaking. Who decides when the fetus is "defective" and when it should be aborted? Under present law, that is the mother's right. But, when the mother was given the right to abort, amniocentesis wasn't available. The mother's decision was based upon information and attitudes that she had about herself. Amniocentesis gives her information about the child, raising the likelihood that decisions on abortion will be made strategically on the basis of its characteristics — its sex, genetic normality, and so on. Amniocentesis may result in a systematic alteration in the gene pool as characteristics regarded by mothers as unfavorable are ruled out. Should abortion be up to the mother only where she has not had amniocentesis and to the doctor when she has? If we are to plan the genetic makeup of the next generation should it be pregnant women acting singly who do it?[28]

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[27] Occasionally, the assignment of rights results in bizarre events, such as the arrest in Omaha of two Bengal tigers (N.Y. Times, Nov. 7, 1980, at 12). Uusually, the events are not humorous. Scientists, for example, who do research on organ transplantation would like to have access to aborted fetuses to study the effectiveness of anti-rejection treatments. Who owns the aborted fetus? (T.H. Maugh, *Transplants (II): Altering the Donor Organ,* 210 Science 177 (1980)). Do the television networks have the right to bar the introduction of a technology that would destroy them? Does the FCC, acting on their behalf? (W.J. Broad, *Upstart Television: Postponing a Threat,* 210 Science 611 (1980)). Does the individual have the right to decide what information is stored about himself electronically? (D.N. Michael, *Speculations on the Relation of the Computer to Individual Freedom and the Right to Privacy,* 33 *Geo. Wash. L. Rev.* 270 (1964)).

[28] Kass, *Implications of Prenatal Diagnosis for the Human Right to Life,* in Biomedical Ethics and the Law. (Humber and Almeder, eds. 1976).

What of the situation where amniocentesis reveals a defect in the fetus — say, Down's Syndrome — but the mother refuses to abort? Should a court order abortion to avoid costs that the Mongoloid child will place upon society? Does the Mongoloid child have a cause of action for "wrongful life" against its mother for refusing to abort when she knew the consequences of birth?

In the case of *Berman* v. *Allan,* 80 N.J. 421, 404 A.2d 8 (1979), the plaintiff sued her doctor for "wrongful birth." She had given birth to a child with Down's Syndrome, a defect that would have been identified by amniocentesis. Her doctor did not inform her of the availability of that technique and the court held that, given the fact that abortion is legal, the doctor was responsible for the mental and physical anguish to the parents by the birth of the defective child. The court rejected the claim by the child's guardian to damages for wrongful life.

As science and technology probe ever more deeply into human nature they generate techniques that are without parallel. The court in *Berman* analogized that situation to a standard malpractice case. If a surgeon inadvertantly leaves a sponge in you, he pays. If an obstetrician leaves a defective baby in you, he pays. But the situation is not fully analogous. The court must push its analysis into unchartered metaphysical realms, unguided by precedent, Constitution or moral philosophy. Questions of this sort take centuries to work out. In centuries the genetic makeup of the human race will have been altered by decisions made today in New Jersey (and other) courtrooms. By then the feedback loop will be broken, for it will be impossible to undo the wrong of a misassessment of rights in 1980. Where the law deals with such powerful phenomena, a mode of analysis more powerful than standard legal analysis is clearly required.

The *Berman* case reveals another aspect of the law/science relationship:

> **Legal rights drive the application of technology. The law does not suppress technology but excites it.**

The mistake that the doctor in *Berman* made was in not informing the plaintiff of the new technology. This is consistent with a general principle of tort law that losses must be avoided if the means exist to do so (economically). The person who inadvertantly causes his neighbor's house to fall in by excavating on his own land is not liable unless technology has provided a tool that would have allowed him to avoid it, such as an earth ram support system. If the tool is available he must use it or he violates his duty of care. It is the duty of each

person to employ any cost-justified technology available for the avoidance of harms.

This principle is an engine that drives the translation of technological possibilities into technological realities. In economic terms, it creates a continuing demand for new technology. This is, of course, regarded by most as anything but a problem. A safer environment is clearly "progress." But to those who view uncritical technological advance as a problem, the law would appear to be more a part of the problem than the solution.

To this point we have been concerned with the effect of science and technology upon the institutions of the law. It comes as no shock that legal institutions, like all others, must yield to change, though there is some question whether the change is for the best. Many writers, however, see a far deeper conflict here:

> **Science reveals that many of the assumptions underlying law are wrong.**

Any normative system is based upon a set of descriptive assumptions about the nature of man and society. We hold people to be responsible for their actions because we believe that they can be — that they can anticipate the effects of their actions and avoid any that bring ill to others. So when a person brings ill upon another, that was a willing act subjecting him to penalty. By penalizing him we induce him and others to behave responsibly. But science casts the possibility of responsibility, and the existence of will itself, into doubt. What of those who for genetic or psychological reasons cannot behave responsibly? They are clearly not "guilty." But what if will is itself an illusion? Copernicus destroyed the illusion that we are the center of the universe. Darwin made us animals. Freud revealed the uncontrolled thought that underlies behavior.[29] And Gödel demonstrated that we can't prove anything.[30] Through it all the law bores valiantly on, sticking with assumptions that it knows are wrong and becoming a little more unsure of itself with each decade.

There is concern that science is devastatingly reductionistic, that will, responsibility, meeting of the minds, loyalty, and love can't survive Occam's razor, that they are characterizations that will be reduced to their objective components with further study. The concept of "ought" makes sense only in a world in which one can meaningfully

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[29] Tribe, *Technology Assessment and the Fourth Discontinuity: The Limits of Instrumental Rationality,* 46 S.Cal. L. Rev. 617.

[30] Leff, *Law and Technology,* 8 Ottowa L. Rev. 536 (1976).

choose between alternatives. If choice is impossible or if it is possible, but one alternative is always demonstrably better than the others, "ought" drops away. The law survives only as a way of allocating decisions to those who can most soundly make them. In such a situation law exists not to shield people from those with power but to assure those with power of the obedience of their subjects. So a town that resists a central edict to install a sewer system is not regarded as expressing values contrary to those of the sewer administrators; it is regarded as being simply, objectively wrong. The law exists to assure conformity to the best wisdom that science and technology can bring to bear. Science transforms normative questions ("What do we want?") into descriptive questions ("What should we want?").

Under this view, law becomes a form of technology, a control system to drive human behavior by the values of a scientific and technological elite. This process is, according to some, already well underway. They propose that:

> **Science and technology are not value neutral. They embody a philosophy, an objective form of utilitarianism, which is imported into law as cost-benefit analysis and drives out other forms of value analysis.**

Under cost-benefit analysis, an action is legitimate if its benefits exceed, on balance, its costs. As between two alternatives, the one with the greater difference between cost and benefit is preferable. It is, under this view, normatively wrong to choose an action that yields opportunity costs, for the common welfare is thereby diminished. But what counts as a cost and a benefit under this scheme? You and I might well differ as to whether the reduction of drug traffic is a cost or a benefit. Whose values are to be the fulcrum upon which this process rests? Some suspect that there is, built into the logic of science and technology, a set of values which serve as the fulcrum.[31] Those values parade as the "common good" or the "public welfare," but are in reality the growth of large scale organization. Science and technology exist to expand organization,[32] to develop an organization ever more capable of controlling its contingencies. Where those contingencies are human, it

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[31] *See,* Ellul, *Technique, Institutions and Awareness,* Amer. Behavioral Scientist 38 (July-Aug. 1958).

[32] Daniel Spreng and Alvin Weinberg argue that the centralization of power is at the essence of technological development. Technology is the process of saving time, of making more powerful actions possible in less time. The only way to do that is through economies of scale, which centralizes power. (*Time and Decentralization,* 109 Daedalus 137 (Winter 1980)).

controls them through law. The logic of cost-benefit analysis embodies the purpose of expanding organizational control over people.

In this view, the relationship between law and science is the battleground between the values of human autonomy and organizational dominance.[33] For the law to adopt the logic of the common good as that is embodied in cost-benefit analysis is for the law to become a tool in the rationalization of life under an organizational purpose. Laws become the job descriptions of the citizen-components of the machine state.

The literature of law/science is largely a literature of concerns, concerns of scientists who have been pricked by law or look to law for salvation, concerns of lawyers who sense an unintelligent force driving change in law. Which of these concerns are well-founded? How do we analyze them? What do they amount to? To answer those questions we must develop an analytical framework within which our observations about the law/science relationship can be recorded. The purpose of Part II of this paper is to devise a number of these frameworks so that the concerns recorded in this part of the paper can be assessed systematically.

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[33] *See,* Tribe, *Legal Framework for Assessment and Control of Technology,* 9 *Minerva* 243 (Apr. 1971), Louisell, *Biology, Law and Reason: Man as Self-creator,"* 16 *Am. J.* Jurts, 1 (1971) and Lasswell, *Must Science Serve Political Power?* Amer. Psychologist 117 (Feb. 1970).

INCORPORATION BY REFERENCE: A CASE HISTORY OF THE EVOLUTION OF A DOCTRINE IN THE PATENT LAW

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By statute, the specification of a United States patent application must "contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same . . .".[1] This language sets forth the fundamental quid pro quo which an inventor must provide in return for the patent grant. That is to say, in return for the seventeen year property right[2] embodied in a patent, the inventor must provide an enabling disclosure, i.e., one which teaches how to practice the invention.

In *General Electric Co. v. Brenner*,[3] the Circuit Court of Appeals for the District of Columbia summarized the meaning and interpretation to be given to this statutory language by noting that the "full, clear, concise, and exact terms"

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[1] 35 U.S.C. §112.

[2] Contrary to the common impression fostered by most of the federal judiciary and certain segments of the patent bar, a patent is not a monopoly and does not confer monopoly rights. Rather, as stated in 35 U.S.C. 261, "subject to the provisions of this title, patents shall have the attributes of personal property." Further, as stated in 35 U.S.C. 154, "every patent shall contain . . . a grant to the patentee, his heirs or assigns, for the term of seventeen years . . . of the right to exclude others from making, using, or selling the invention throughout the United States . . .". There is nothing in the statute which in any way grants a guaranteed right to practice the invention to the patentee.

[3] 407 F.2d 1258, 159 U.S.P.Q. 335 (1968).

> . . . need only be reasonable with respect to the art involved; they need not inform the layman nor disclose what the skilled already possess. They need not describe the conventional.*** The intricacies need not be detailed ad absurdum. The skill of the inquiring artisan must be taken into account.*** Where the complexity dictates, broad terminology complies with the statute.[4]

There is another side to the coin, however. There may well be — and indeed frequently is — a difference of opinion between an applicant for a patent and the Patent and Trademark Office (hereinafter the Office) as to the level of skill of one skilled in the particular art, i.e., the skilled artisan, and whether a person at that level of skill could make and use the invention from the disclosure presented.[5] Moreover, it is not enough to convince a patent examiner that the disclosure is enabling; any federal court interpreting the validity of the patent must also be convinced.

Considerations such as these suggest that it is highly preferable to maximize the disclosure so as to minimize the possibility that validity can or will be questioned on this account. Pragmatically, however, there are practical limitations on just how much information can reasonably be provided in the specification of a patent application. While patents have issued with specifications well in excess of one-hundred pages in length,[6] it is questionable whether in most instances a specification in excess of perhaps twenty printed pages is necessary or can really be justified.

In this regard, a specification containing detailed and elaborate descriptions of every facet of every embodiment of the invention is not only expensive to prepare but may actually obfuscate rather than clarify and enable the practice of the invention.[7] It is not surprising therefore that the question arose as how to best provide an enabling disclosure without unduly burdening the Office in the examination of the application and the general public in determining exactly what the invention is. It is with this background in mind that it is now appropriate to turn to how the doctrine of incorporation by reference came into existence in the patent law.

The Early Case Law

The doctrine of incorporation by reference is a time honored one in

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[4] *Id.* at 1259, 159 U.S.P.Q. at 337.

[5] D.G. Conlin, "The Patent Application," Chap. 9 at page 9-21 in Patent Preparation & Prosecution Practice, vol. II (Patent Resources Institute, Inc., 1976).

[6] Thus, for example, U.S. patent 3,077,984 issued with 485 pages. See *General Electric Co. v. Brenner,* 407 F.2d 1258, 159 U.S.P.Q. 335, 336 (D.C. Cir. 1968).

[7] Conlin at pages 9-21 and 9-22.

the law. It has been defined as "the method of making one document of any kind become a part of another separate document by referring to the former in the latter, and declaring that the former shall be taken and considered as a part of the latter the same as if it were fully set out therein."[8] As noted by the Circuit Court in *General Electric,* the doctrine

> ... is more clearly associated with the law of wills where it antedates the federal system. It is the offspring of the economies of time and space and is used to enable one document to become part of another by reference and to take effect as if the former clearly outlined the latter. In the law of patents, however, incorporation by reference is a new arrival. Its birth has been retarded by a too literal reading of the statutes.[9]

Although it is not entirely clear when the doctrine first found its way into the patent law, the court in *General Electric* suggested[10] that it first received judicial approval for use in a patent application in *Lynch v. Headley*[11] in 1923. There, the issue arose as to whether a reference in a patent application to a "regulator", details of which were said in the application to be given in a U.S. patent set forth by number, was sufficient to comply with the enabling disclosure requirement of the statute then in effect.[12] The Circuit Court for the District of Columbia agreed with the Assistant Commissioner of Patents that it was "unnecessary to insist that the applicants here should have shown all the details which was [sic] already disclosed in that [prior] patent. It was sufficient for them *to incorporate it by reference.*"[13] (Emphasis supplied.)

The Court of Customs and Patent Appeals (C.C.P.A.) made an oblique mention of incorporation by reference in 1930 in *In re Stauber.*[14] The claims had been rejected on the grounds that the specification contained inadequate disclosure to teach how the apparatus of the invention operated. Although the specification stated that certain well known processes could be used to assure the correct operation of the claimed apparatus, Stauber did not provide the Office with any example of such a process and stood only on the teaching of his specification. It was only on appeal to the C.C.P.A. that Stauber for

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[8] Black's Law Dictionary (4th Ed.). As will be seen, however, this definition is not the one followed in the patent law.

[9] 407 F.2d 1260, 159 U.S.P.Q. at 337.

[10] *Id.*

[11] 52 App.D.C. 269, 285 F. 1003 (D.C. Cir.).

[12] R.S. 4888.

[13] 52 App.D.C. at 270, 285 F. at 1004.

[14] 45 F.2d 661, 7 U.S.P.Q. 258 (1930).

the first time provided examples of prior art patents which he argued provided the necessary information by which his device could readily be operated.

The C.C.P.A., however, refused to accept the evidence of these patents, apparently on the ground that what was not of record before the Office could not be used as evidence before the court. In so doing, however, Judge Graham, speaking for the court, made the following observation:

> If the appellant had desired to do so, he might have cited and referred in his application to such patents, or to any other patents, and, by such reference, have made them a part of his application. This he did not do, and, therefore, they cannot be considered now.[15]

There are several interesting points raised by this language. First of all, it certainly seems to suggest that a mere reference to a prior art patent,[16] without more, would be sufficient to incorporate it by reference. Secondly, it rather strongly implies that if the teaching of the prior art was required to supplement the teaching of the specification in order to make it enabling, then the specification must be amended to make a reference to such prior art so that it could be incorporated by reference. Finally, as a corollary to the second point, it would seem that the court was indicating that it was perfectly proper to amend the specification to add such a reference.

Surprisingly, almost two decades passed before there was any further judicial comment concerning incorporation by reference in the patent law. In 1948, however, the C.C.P.A. finally was presented with an opportunity to clarify the language used in *Stauber*. The occasion was *In re Chaplin*[17] and the facts — with one important exception — were similar to those in *Stauber*. That exception was that after the inadequate disclosure rejection was presented, Chaplin attempted to amend his specification to cite certain patents which he argued disclosed the prior art referred to in his application as originally filed.[18] The examiner refused to enter the amendment on the ground that it

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[15] *Id.* at 664, 7 U.S.P.Q. at 261.

[16] Presumably, the reference in the specification would have to adequately identify the patent in question.

[17] 168 F.2d 85, 77 U.S.P.Q. 601 (1948). In his original specification he had stated: "Suitable mechanism is provided for driving the various parts of the machine in desired synchronism. These mechanisms are not shown as they are well known in the art."

[18] *Id.* at 87, 77 U.S.P.Q. at 603.

involved new matter,[19] and this refusal was upheld by the board of appeals.[20]

On appeal to the C.C.P.A., the solicitor for the Office sought to rely heavily on the language from *Stauber* which has been quoted above. But the court distinguished that language, saying:

> Considering that excerpt apart from the context of the opinion, it supports the contention of the solicitor that if prior patents are not referred to in appellant's original application, they cannot thereafter be referred to by amendment. However, in that case it appears that the Patent Office gave appellant several opportunities to amplify his application but that appellant failed and refused to do so; that when the quoted excerpt is considered in the light of our opinion in that case, it is clear that although appellant was given the opportunity to amend his application, he refused to do so; and that on review to this court, we could not consider any amendment which might *at that time* be suggested.[21]

The court went on to hold that the amendment was proper and did not constitute new matter.[22]

Chaplin appeared to make incorporation by reference an important consideration whenever the teaching of a specification was deemed not to be enabling in and of itself. That is to say, if an applicant was compelled to rely on the teaching of the prior art to show enablement, then a strong inference was raised by this opinion that to "amplify the application" by use of such teaching required an incorporation by reference.[23]

Before going further, it is appropriate to obtain some indication of the position taken by the Office in the long interim between *Stauber* and *Chaplin.* Perhaps not surprisingly, the published opinions of the board of appeals suggest that during this period there was no entirely consistent view prevailing in the Office.

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[19] Although the judicial record does not expressly so state, this refusal was clearly made in accordance with the predecessor statute to the present 35 U.S.C. 132 which states "No amendment shall introduce new matter into the disclosure of the invention."

[20] 168 F.2d at 87, 77 U.S.P.Q. at 603.

[21] *Id.*

[22] There is some question whether this holding is consistent with the later case law concerning new matter rejections. For a discussion of the current case law in this area, see Walterscheid, "Insufficient Disclosure Rejections (Part IV), 62 J.P.O.S. 361 (1980).

[23] Such an inference is consistent with an earlier position taken by the court that an applicant could not rely on a prior art patent to supply the meaning of a term used in his application when that patent was not referenced in his specification. See In re Adams, 117 F.2d 1017, 48 U.S.P.Q. 563 (C.C.P.A. 1941).

Thus, for example, in *Ex parte Strassberger*[24] decided in 1940, the issue before the board was whether the preparation of a particular starting compound used in the process claimed was required to be described in the specification. Strassberger had made of record before the examiner a British patent which described how to make the starting material. The board ruled that the British patent made publicly available a method of preparing the starting material and therefore it was unnecessary to describe a method in the specification. The board went on to state, however, that:

> It may be advisable in the present case to insert a reference to the British patent in the specification so as to aid the public in locating it. *As the public is assumed to have constructive knowledge of all issued patents and publications, this requirement is not absolutely essential.*[25] (Emphasis supplied.)

In 1943 in *Ex parte Kinzie and Commons, Jr.*,[26] the board took the position that the specification in question had a defective disclosure even though it made specific reference to a patent with a disclosure which remedied the defect. The board held that the patent disclosure could be effectively incorporated by reference if the specification of the application on appeal was amended to make a direct reference to the patent at each point where it was necessary to use the patent to identify a particular product.

In 1945 in *Ex parte Hentrich, Kaiser, and Endres*[27] the board held that a statement that a particular material is similar in type to that disclosed in a prior, copending patent imports the disclosure of the patent into the application. Likewise in that same year the Board held in *Ex parte Longhridge*[28] that even though the specification did not disclose all terms used in certain claims, it nontheless provided a sufficient disclosure because it referenced a prior patent which clearly disclosed them.

To this point in time, the published opinions had been concerned with incorporation of a disclosure from an issued patent. In 1948 in *Ex parte Teter and Shand*[29] the board emphasized that the knowledge incorporated by reference must be available to the public, saying:

> A disclosure of the [knowledge]... in a pending application, while sufficient to support the allegation that [it]... was well known at the time

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[24] 49 U.S.P.Q. 402 (Bd.App. 1941).

[25] *Id.* at 403.

[26] 60 U.S.P.Q. 462 (Bd.App. 1944).

[27] 66 U.S.P.Q. 492 (Bd.App. 1945).

[28] 72 U.S.P.Q. 182 (Bd.App. 1947).

[29] 105 U.S.P.Q. 192 (Bd.App. 1955).

> that this application was filed, does not guarantee that this knowledge would be available to the public if and when the present application should mature into a patent because the application containing the necessary information may become abandoned or may not issue in time.[30]

It went on to note that the necessary information could properly be incorporated by reference to an issued patent[31] or to a publication antedating the filing date of the application.[32]

Expanding the Scope of the Doctrine

It is apparent from these opinions by the board of appeals that at the time *Chaplin* was decided, the Office was not only permitting incorporation by reference but was actively encouraging it. Within two years of *Chaplin* the C.C.P.A. took the opportunity in *In re Heritage*[33] to emphasize that "[t]here can be no question but that in a patent application, the disclosure thereof may be supplemented by reference to another patent."[34]

More importantly, *Heritage* signalled what appeared to be judicial approval of a significant expansion of the doctrine of incorporation by reference in the patent law. To understand why this was so requires a bit of background. Rule 108 of the Rules of Practice of the Patent and Trademark Office states that abandoned applications *as such* will not be cited as references in support of a rejection.[35] Rule 108 was in effect at the time that *Heritage* was decided.[36] It was also in effect at the time (1948) that the C.C.P.A. presented its opinion in *In re Switzer*.[37]

In *Switzer* the applicants had sought to remove a patent relied on as a reference by the examiner by filing an affidavit under then Rule 75.[38] The court held that the affidavit was ineffective to antedate or

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[30] *Id.* at 194.

[31] Provided that the patent had a filing date prior to that of the application into which it was incorporated.

[32] Insofar as can be ascertained, this was the first published statement that incorporation by reference could be used with a publication other than an issued patent.

[33] 182 F.2d 639, 86 U.S.P.Q. 160 (C.C.P.A. 1950).

[34] *Id.* at 643, 86 U.S.P.Q. at 164.

[35] 37 C.F.R. §1.108 (July 1, 1978 Rev.). The only exception is the situation wherein the applicant and his assignee file a formal waiver of rights which includes an authorization to open the complete application to the public. See 37 C.F.R. §1.139 (July 1, 1978 Rev.).

[36] See, e.g., *Ex parte MacDonald,* 113 U.S.P.Q. 262, 264 (Bd.App. 1956).

[37] 166 F.2d 827, 77 U.S.P.Q. 156 (C.C.P.A. 1948).

[38] The present counterpart in 37 C.F.R. §1.131 (July 1, 1978 Rev.) which states in pertinent part:

avoid the teaching of three abandoned applications referred to in the patent as copending applications of which the application which resulted in the patent was said to be a continuation-in-part.[39] This was interpreted as a holding that in this particular fact situation an abandoned application is prior art which may properly be cited to support a rejection.[40]

Just prior to the time that *Switzer* was being decided,[41] the board of appeals was issuing its opinions in *Ex parte Heritage,*[42] which involved the same inventor but a different application than those appealed in *In re Heritage. In Ex parte Heritage* the board reversed certain rejections, one of which was based on the teaching of certain prior art patents. In so doing, however, it held that an *abandoned* application referenced in a patent to one Finck was incorporated by reference into the patent and formed a part of the disclosure thereof.[43] It expressly stated that the fact that the application was abandoned was not material in that the abandoned application had been copending with the later application which resulted in the patent.[44]

> When any claim of an application is rejected on reference to a domestic patent which substantially shows or describes but does not claim the rejected invention, or on reference to a foreign patent or to a printed publication, and the applicant shall make oath or declaration as to facts showing a completion of the invention in this country before the filing date of the application on which the domestic patent issued, or before the date of the foreign patent, or before the date of the printed publication, then the patent or publication cited shall not bar the grant of a patent to the applicant, unless the date of such patent or printed publication be more than one year prior to the date on which the application was filed in this country.

[39] The purpose of stating that the application which resulted in the patent was a continuation-in-part of the earlier applications which were abandoned was to obtain the benefit of the filing date of these earlier applications with regard to common subject matter in them. See 35 U.S.C. 120 as set forth at note 145, *infra.*

[40] See headnote 2, 77 U.S.P.Q. at 156. It should be noted that the examiner did not cite these applications as prior art but rather relied on the patent in which they were referenced. As will be shown, in light of Rule 108, the Office considered the distinction to be important. See the text accompanying notes 46-51, *infra.*

[41] The opinions of the board of appeals in *Ex parte Heritage* were dated Dec. 18, 1947 and Jan. 20, 1948 whereas *Switzer* was decided Jan. 27 and Apr. 2, 1948. The reason for two dates in each of the cases was that in each instance there was a request for reconsideration which was acted on.

[42] 77 U.S.P.Q. 179 (Bd.App. 1948).

[43] *Id.* at 181 and 182.

[44] *Id.* at 182.

In the context of what follows it is important to note that the specification of the Finck patent did more than just reference the abandoned application. There was ample language therein to show that Finck clearly intended to incorporate the disclosure of his abandoned application into the application which became the patent.[45]

It is with this framework in mind that the C.C.P.A. opinion in *In re Heritage* must be considered. The facts were quite similar to those in *Ex parte Heritage* with the Finck patent being cited in support of one of the rejections. A significant difference was that the board relied on the teaching of the abandoned application as incorporated into the Finck patent to uphold the rejection. It did this even though the examiner "specifically stated that the copending application of Finck, referred to in his patent and subsequently abandoned, was not relied on."[46]

The C.C.P.A. expressly sanctioned the authority of the board to do this, saying:

> We do not deem it necessary to refer to the disclosure of the abandoned application referred to in the Finck patent, although, in our opinion, such reference was properly discussed in the board's decision.
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> * * *
>
> It must be remembered that the abandoned application by itself was not cited by the board as a reference, and *since it was referred to by the patentee in his specification, it surely became part of the disclosure set out therein.*[47] (Emphasis supplied.)

It is not at all clear why the court chose to indicate by its use of the emphasized language that *a mere reference* to an abandoned application in an issued patent was sufficient to incorporate by reference.[48] Nonetheless it did so, and some eighteen years would pass before it acted to limit the scope of this holding.[49]

Consider for a moment the ramifications of that statement. Contrary to the traditional doctrine of incorporation by reference,[50] the court was saying that a mere reference to an abandoned application in an issued patent was — without more, i.e., any statement of incor-

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[45] *Id.* at 181.

[46] 182 F.2d at 642, 86 U.S.P.Q. at 163-164.

[47] *Id.*

[48] There was really no need to so indicate because the board had taken care to emphasize that Finck's specification clearly showed that he had intended to incorporate the content of his abandoned application. See 77 U.S.P.Q. at 181.

[49] See the text accompanying notes 76 and 77, *infra.*

[50] See the text accompanying notes 8 and 9, *supra.*

poration — sufficient to import the disclosure of the abandoned application into the specification of the patent. This meant that the Office could properly use the disclosure of the abandoned application as a reference. It could therefore avoid the express language of Rule 108 on the semantic ground that the abandoned application was rendered a part of the specification of the issued patent which could properly be cited in support of the rejection. Moreover, this holding was in the not too distant future to be interpreted as allowing the parties to an infringement action to rely on the disclosure of an abandoned application referenced in an issued patent.[51]

The Office, however, chose to interpret the C.C.P.A. language in *Heritage* in a considerably more circumspect fashion.[52] Thus, for example, in *Ex parte Gresham and McAlevy*[53] the examiner relied on the disclosure of an abandoned application "mentioned" in an issued patent to one Dreyfus to support an obviousness-type rejection of certain of the claims. There apparently was copendency[54] before the abandonment occurred although the published opinion does not expressly so state. The examiner cited only the patent and not the abandoned application, presumably to avoid the constraint of Rule 108, on the ground that the disclosure of the abandoned application had been incorporated into the specification of the Dreyfus patent by the reference contained therein. The board refused to accept this premise, saying:

> We do not consider the abandoned application as a reference against this application, *since no reliance is made in the Dreyfus patent for completion of its disclosure upon the abandoned application and there is no special relationship between the applications, such as continuation-in-part.*[55] (Emphasis supplied.)

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[51] See, e.g., *B.F. Goodrich Co. v. U.S. Rubber Co.*, 147 F.Supp. 40, 111 U.S.P.Q. 397, 411, n. 39 (D.Md. 1956), affd., 244 F.2d 468, 113 U.S.P.Q. 393 (4th Cir. 1957).

[52] Thus, for example, according to the Manual of Patent Examining Procedure which is the bible of the patent examining corps, "In re Heritage... holds that where a patent refers to and relies upon the disclosure of a copending abandoned application, such disclosure is available as a reference," See M.P.E.P. 901.02 (Rev. 53, July 1977) and *Ex parte Schacter,* 139 U.S.P.Q. 380, 381 (Bd.App. 1962).

[53] 90 U.S.P.Q. 350 (Bd.App. 1951).

[54] Copendency means that the earlier application was still actively pending before the Office at the time the second application was filed. The first application is actively pending at the time the second application is filed if the first application has not yet resulted in an issued patent, it has not been abandoned, and there has been no termination of proceedings with respect to it. See 35 U.S.C. 120 as set forth at note 145, *infra.*

[55] 90 U.S.P.Q. at 349-350.

Although this language is susceptible to differing interpretations, it is certainly implied that before an incorporation would be considered to have occurred the reference to the subsequently abandoned application must be such as to show an intent to incorporate. It was not clear whether the existence of the "special relationship," e.g., a statement that the later filed application is a continuation-in-part[56] of the earlier filed application would be sufficient in and of itself to incorporate the content of the earlier application into the later one or whether the board was indicating that there must be language to show both the necessary intent *and* the special relationship.

Two years later the board strongly suggested in *Ex parte MacDonald*[57] that it had adopted the latter view. As stated by the board, an issue in *MacDonald* was

> ... essentially whether or not matter in an abandoned application which is not carried over into a continuing application and is not relied upon therein for completion of its disclosure is available as a reference against another who filed while the continuation application in question was still pending and therefore secret.[58]

In holding that it was not, the board noted that:

> The examiner recognizing that Rule 108 prohibits the use of abandoned applications as references as such notes that they may nevertheless be used as references under the circumstances set forth in Ex parte Heritage...; In re Heritage...; In re Switzer...; and Ex parte Gresham.... The tenor of these decisions appears to be that (1) where a patent relies for completion of its disclosure upon the abandoned application and (2) there is a special relationship between the application such as "division" or "continuation-in-part" then the abandoned application is a proper reference because the disclosure has, in effect, been incorporated by reference into the patent and is available to the public.[59]

In view of the analysis of the cited decisions given herein, one may question whether their tenor was as clearcut as the board indicated. Be that as it may, there was now little doubt that insofar as the board was concerned a mere statement indicating that an application which matured into a patent was a continuation-in-part was not in and of itself sufficient to *automatically* incorporate the subject matter dis-

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[56] M.P.E.P. 201.08 (Rev. 49, July 1976) states:

> A continuation-in-part is an application filed during the lifetime of an earlier application by the same applicant, repeating some substantial portion or all of the earlier application and adding matter not disclosed in the said earlier application.

[57] 113 U.S.P.Q. 262 (Bd.App. 1956).

[58] *Id.* at 265.

[59] *Id.* at 264.

closed in the abandoned parent[60] application.[61]

Nonetheless, the language used by the board in framing the issue in *MacDonald* still raised questions. Could the subject matter of an abandoned parent application be incorporated by reference when it was not required to complete the disclosure of the later application? What would be the effect of an express statement of intent to incorporate in this particular circumstance? What if there was an express intent to incorporate in this particular circumstance? What if there was an express intent to incorporate but no "special relationship"? What was meant by completion of the disclosure? Completed in what sense? To overcome a lack of enablement or something else? What of the circumstances wherein the *only* reference to the abandoned parent application is the statement that the daughter application is a continuation-in-part of the parent but the subject matter of the parent is required to render the daughter enabling? In this last situation an applicant might well argue that the mere statement that the daughter is a continuation-in-part is sufficient without more to incorporate the disclosure of the parent into the daughter. Indeed, this particular situation would become a matter of considerable controversy in the case law.[62]

Heretofore, it had been examiners who had sought to rely on an incorporation by reference from an earlier filed, copending application to support a particular rejection. Inevitably, the time came when applicants sought to rely on such an incorporation to overcome a rejection. The first published board opinion dealing with this point appears to have been *Ex parte Gottschalk*[63] in 1959, wherein the board held "that a reference may be made to a copending patent having an

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[60] M.P.E.P. 201.04 (Rev. 56, July 1978) states:

> The terms *original* and *parent* are interchangeably applied to the first in a series of applications of an inventor, all disclosing a given invention. Such invention may or may not be claimed in the first application.

[61] The board in *MacDonald* was quite careful to frame the issue in terms of the facts in that case, i.e., limited to the situation wherein the reference patent had not yet issued at the time the MacDonald application was filed. This was perfectly proper under 35 U.S.C. 102(e). However, if the patent had issued prior to the date MacDonald's application was filed, it is clear that the board would have been made the same holding, since in its view the critical factor was whether the patentee had done all he could to make the description public. According to the board "this would at least have required a carrying forward into the later application of the subject matter in controversy." 113 U.S.P.Q. at 265.

[62] See, e.g., the text accompanying notes 135-146, *infra*.

[63] 124 U.S.P.Q. 140 (Bd.App. 1959).

earlier filing date to complete the disclosure of a pending application."[64] As a practical matter, the holding was even broader because the referenced application which resulted in the patent was by another inventor and hence there was no "special relationship."[65] Unfortunately, the opinion fails to indicate in what manner the reference was made so that it is unclear whether the board intended to hold that the mere reference was sufficient without more to establish the incorporation.

At this same time, a variation on the theme was argued before the C.C.P.A. in *In re Joliot.*[66] The applicants in *Joliot* had stated in their application that the materials disclosed therein were useful in combination with the "dispositions" set forth in two of their other applications referred to in blank.[67] During the appeal, they identified these two prior, copending applications by serial number and asserted that the blank reference to them provided an incorporation by reference and that their disclosure taken together with that of the application on appeal provided the necessary enablement. There is nothing in the published opinion of *Joliot* to indicate that there was any "special relationship" between the application on appeal and the two referenced applications which were identified by the court for convenience as U.S. I and U.S. II.

The determinative issue insofar as the C.C.P.A. was concerned was that U.S. I and U.S. II had been abandoned after being rejected as having nonenabling disclosures. Judge Martin, speaking for the court, stated:

> Assuming, arguendo, that the disclosures of U.S. I and U.S. II may be properly incorporated in the disclosure of the application on appeal by the reference in blank therein, the two prior disclosures here involved cannot be used to introduce an operative disclosure because of the previous final adjudication as to their insufficiency.[68]

In other words, the court did not bother to reach the issue of whether there had been a proper incorporation by reference because, even assuming there had been, the subject matter incorporated was insufficient to overcome the lack of enablement rejection.

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[64] *Id.* at 141.

[65] 35 U.S.C. 120 requires common inventorship for the "special relationship." See note 145, *infra.*

[66] 270 F.2d 954, 123 U.S.P.Q. 34 (C.C.P.A. 1959).

[67] Presumably this was because at the time they filed the application on appeal they had not received the serial numbers of the two referenced applications from the Office.

[68] 123 U.S.P.Q. at 346.

During this period, the federal courts were interpreting *In re Heritage* much more broadly than was the Office and were holding that a reference to an earlier filed copending application was in and of itself sufficient to incorporate the disclosure of the application.[69]

It may be recalled that in *Gottschalk* the board had permitted an applicant to rely on a copending application by a different inventor to complete his disclosure. In 1964 in *In re Fried*[70] the C.C.P.A. expressly approved this view, saying "[w]e do not see that reliance on a *commonly assigned* application, cited in the specification as filed, can be barred merely because of different inventorship."[71] While the emphasis placed on "commonly assigned" might suggest a different opinion if the application relied on was not commonly assigned, as a practical matter it is a rare case wherein an applicant would even be aware of anything other than a commonly assigned, copending application.

Another aspect of the *Fried* opinion is of interest in the context of the present article. The C.C.P.A. also held in that case that a prior filed, copending application incorporated by reference for a specific purpose could properly be relied on for *all* that it discloses and not merely the specific material set forth in the statement of incorporation.[72] The court also ruled that if the copending application had not issued as a patent, a waiver of secrecy by the common assignee effectively made it publicly available.[73]

In 1967 the C.C.P.A. finally got around to consideration of the issue of whether the existence of the "special relationship," i.e., the daughter application being a continuation-in-part or a division[74] of the parent application, was alone sufficient to incorporate the disclosure of

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[69] See, e.g., *Rolls-Royce Ltd. v. United States,* 339 F.2d 654, 143 U.S.P.Q. 445, 449 (Ct.Cl. 1964); *Technograph Printed Circuits, Ltd. v. Bendix Corp.,* 218 F.Supp. 1, 137 U.S.P.Q. 725, 749 (D.Md. 1963); *National Latex Products Co. v. Sun Rubber Co.,* 274 F.2d 224, 123 U.S.P.Q. 279, 283 (6th Cir. 1960); and *B.F. Goodrich Co. v. U.S. Rubber Co.,* 147 F.Supp. 40, 111 U.S.P.Q. 397, 411, n. 39 (D.Md. 1956), affd., 244 F.2d 468, 113 U.S.P.Q. 393 (4th Cir. 1957).

[70] 329 F.2d 323, 141 U.S.P.Q. 27 (C.C.P.A. 1964).

[71] 141 U.S.P.Q. 27, 28n.4 (C.C.P.A. 1964).

[72] *Id.* at 28 and 29.

[73] 141 U.S.P.Q. at 29.

[74] M.P.E.P. 201.06 (Rev. 56, July 1978) states:

> A later application for a distinct or independent invention, carved out of a pending application and disclosing and claiming only subject matter disclosed in the earlier or parent application, is known as a divisional application or "division."

the abandoned parent into the specification of the daughter. The vehicle chosen for this exercise was *In re Lund.*[75]

Perhaps the most striking fact about *Lund* is that the positions taken by the Office and the court were reversed from that suggested by their earlier pronouncements. Fortunately, the background leading to the opinion was straightforward. Certain claims had been rejected by the examiner on the ground that they were anticipated or at least rendered obvious by an Example 2 set forth in the abandoned parent application to a patent to one Margerison. According to the court:

> The examiner stated, and the board and solicitor do not disagree, that the patent "has not carried forward the disclosure that is being relied upon by the examiner as the prior art."
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> * * *
>
> The examiner has stated that the disclosure of Example 2 of the abandoned... application has been "incorporated by reference" into the patent disclosure. The inference we draw from the examiner's and board's statements is that they view the patent specification acknowledgement that it is a "continuation-in-part" of the abandoned... application as accomplishing incorporation of the entire disclosure of the abandoned application, including Example 2, into the disclosure of the patent, with the result that appellants' invention is described, if not explicitly, at least implicitly, in the Margerison patent.[76]

The court, however, refused to accept this argument, saying "there is little in the term 'continuation-in-part' which would suggest to the reader of the patent that a disclosure of the nature of Example 2 is present in the earlier application and that it should be considered a part of the patent specification."[77]

Needless to say, the C.C.P.A. recognized that it had a problem in reconciling this holding with the language it had used in *In re Heritage.* But rather than simply acknowledging that it now felt that the *Heritage* language was too broad, it sought to distinguish that case, contending that:

> While the manner in which the Finck abandoned application disclosure was incorporated by reference to supplement the patent discloure is not entirely clear from the Heritage opinion, the manner is clearly reflected in the decision of the Board of Appeals in Ex parte Heritage... which involved a Heritage application related to that appealed to this court. It should be apparent that the court, in stating that the Finck patent "referred to" the abandoned application, did not intend to imply that *any* man-

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[75] 376 F.2d 982, 153 U.S.P.Q. 625 (C.C.P.A. 1967).

[76] *Id.* at 988, 153 U.S.P.Q. at 631.

[77] *Id.*

> ner of reference to an earlier application was sufficient to incorporate the entire disclosure or any part thereof by reference into the patent.[78]

As has been noted earlier, this "apparent" point was missed entirely by several other federal courts.[79] Indeed, this is not surprising in that the rationalization presented by the C.C.P.A. glosses over the following facts in *In re Heritage:* (a) there was no discussion whatsoever concerning the manner of incorporation by reference into the Finck patent, (b) there was no reference to *Ex parte Heritage;* and (c) there was nothing in the opinion which suggested that the language used therein was limited to the particular facts of that case.

Be that as it may, *Lund* represented the first judicial effort to restrict the ever growing scope of the doctrine of incorporation by reference. Soon the Office would attempt to do the same. But, during the same week that *Lund* was decided, the board of appeals held that a rejection under 35 U.S.C. §102 citing only a single patent as providing the anticipating teaching was proper because the patent referred to and hence incorporated by reference the disclosure of another patent which supplied certain disclosure not found in the specification of the cited patent but necessary to support the rejection.[80] This appears to have been a rather ingenuous attempt by the examiner and the board to shoehorn into Section 102 what should more properly have been a 35 U.S.C. §103 rejection.[81]

Defining the Role of the Office

Although the Office had not been reluctant to apply the doctrine of incorporation by reference to uphold various rejections, it had a more difficult time in determining to what extent it would allow an applicant to use the doctrine to supply additional disclosure to his application. As early as 1959 the board of appeals in *Gottschalk* had approved the incorporation of a copending patent having an earlier filing date to complete the disclosure of a pending application and thereby avoid a rejection.[82] But several years thereafter the Office had sec-

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[78] *Id.* at 989, 153 U.S.P.Q. at 632.

[79] See the cases cited in note 69, *supra.*

[80] *Ex parte Charlesby,* 157 U.S.P.Q. 709 (1967).

[81] The general rule is that rejections under 35 U.S.C. 102 are proper only if the claimed subject matter is identically disclosed or described in a *single* prior art reference. See, e.g., *In re Marshall,* 578 F.2d 301, 198 U.S.P.Q. 344, 346 (C.C.P.A. 1978).

[82] See the text accompanying notes 63-65. *supra.*

ond thoughts. Caught right in the middle was the corporate assignee in *General Electric Co. v. Brenner*.[83]

In 1960 General Electric filed nineteen patent applications for the purpose of securing patent protection for a computer system developed by the company. Each application contained identical drawings and the same disclosure of the computer system but had a different introductory portion and claims relating to a particular aspect of the system. These applications were massive in size as evidenced by the fact that one of them by a Robert R. Johnson which issued as a patent in February 1963 contained 485 pages.

The inventor in another of the General Electric applications was a man named Herold. On February 28, 1963 the claims of the Herold application were rejected, but in this same Office action the examiner pointed out that substantial portions of Herold's specification were identical to that of the Johnson patent and suggested that a large savings in printing costs could be achieved if virtually all of Herold's specification were cancelled and the cancelled portion incorporated by reference from the Johnson application. Patent counsel for General Electric were not certain of the propriety of such an approach and sought an official ruling from the Commissioner. On August 23, 1963, N.H. Evans, the Director, Examining Operation II, acting for the Commissioner, upheld the examiner's suggestion that there be an incorporation by reference and in effect made it a requirement. Accordingly, on December 30, 1963 Herold's application was amended to delete the common disclosure and to incorporate the Johnson patent by reference. The effect of this amendment was to reduce the Herold application to only seven pages.[84]

And that's when things began to get really complicated for General Electric. For, lo and behold, on April 29, 1965, the amendment was refused entry and the requirement put forth by Mr. Evans on August 23, 1963 was vacated. General Electric thereupon petitioned the Commissioner to resolve the disparity of the two rulings. Back came Mr. Evans on August 3, 1965, affirming the examiner's action on the ground that "the claimed subject matter must be disclosed in the application without reference to another application."[85]

The published opinion in *General Electric* does not disclose what authority if any the Office gave for that position. General Electric may be excused if by this time their patent counsel were becoming a

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[83] 407 F.2d 1258, 159 U.S.P.Q. 335 (D.C. Cir. 1968).

[84] *Id.* at 1259, 159 U.S.P.Q. at 336.

[85] *Id.*

bit annoyed with the Office. Aside from the fact that they were seeking to incorporate the disclosure of an issued patent rather than an application, they had acted in good faith only to find themselves back in the position they had commenced with two and one-half years earlier. Once again, they petitioned the Commissioner for reconsideration and withdrawal of this ruling.

Again, on June 8, 1966 Mr. Evans denied the petition, this time giving as his reason the requirement of 35 U.S.C. §154 that "A copy of the specification and drawings shall be annexed to the patent and be a part thereof." This ruling was of considerable interest in view of the fact that less than a month earlier, a five-member panel[86] of the board of appeals had stated in *Ex parte Schwarze*[87]

> ... that an application as filed, in order to comply with the requirements of 35 U.S.C. 112, must be complete in itself. This is not to be taken as a bar to the incorporation by reference in the application as originally filed of subject matter presented in earlier-filed copending applications.[88]

Apparently, the left hand did not know what the right hand was doing.[89] Moreover, the quoted statutory requirement of 35 U.S.C. §154 had been in existence at least since the passage of the Patent Act of 1952. Why was the Office only now relying on it? Clearly, the Commissioner had now become concerned about the broad scope of the doctrine of incorporation by reference and was attempting to severely limit its use.

Indeed, if taken literally, the quoted language from 35 U.S.C. §154 appeared to preclude any incorporation by reference at all. The Commissioner, however, did not take this tack but instead seems to have argued that the existing case law allowed incorporation by reference of nonessential but not of essential material.[90] It was obvious that the

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[86] A normal panel is three members, but for decisions considered to be important a larger panel may sit. In rare instances, the entire board may sit *en banc.*

[87] 151 U.S.P.Q. 426 (Bd.App. 1966).

[88] *Id.* at 427.

[89] It might be argued that the language of the board in *Schwarze* could be reconciled with the Commissioner's ruling on the ground that the board was speaking only of incorporation by reference in the application *as filed* and had in fact ruled that language added after the date to bring about an incorporation by reference was prohibited as "new matter" under 35 U.S.C. 132. 151 U.S.P.Q. at 428. This argument, however, should not be applicable under the circumstances of *General Electric* because the disclosure sought to be incorporated by reference in the later amendment had in fact been present in the application as filed. There thus was not statutory basis for considering it prohibited new matter. Indeed, in *General Electric* the Office never took that position.

[90] 407 F.2d 1258, 1263 n.9, 159 U.S.P.Q. 335, 338 n. 9 (1968).

matter sought to be incorporated by reference was essential because without it the specification was nonenabling, i.e., it failed to comply with the requirements of 35 U.S.C. §112.

Having exhausted its administrative remedies, General Electric now turned to the district court for the District of Columbia in an effort to require the Office to enter the amendment setting up the incorporation by reference. The district court gave it short shrift, however, granting summary judgment to the Office. That ruling in turn was appealed to the Circuit Court of Appeals for the District of Columbia. There, General Electric was finally vindicated.

The Circuit Court set forth the issues as:

> Whether the Commissioner of Patents has the authority, under the applicable statutes and regulations, to issue a patent upon an application which incorporates, by reference, in its disclosure, substantial portions of a disclosure of an existing patent? If he does have such power, to what extent may "incorporation by reference" be permitted?[91]

Insofar as the circuit court was concerned, the answer to the first question depended on whether incorporation by reference complied with the enabling disclosure requirement of 35 U.S.C. §112. The court was of the view that as long as the subject matter sought to be incorporated by reference was available to the public, such incorporation would be permitted by Section 112. Accordingly, it held that the Commissioner had authority in this circumstance to issue a patent which relied upon a disclosure incorporated by reference. It went on to say that if the requirements of Section 112 are met, then the application also meets the requirements of Section 154.[92]

In answer to the second question, the court said in essence that as long as the material sought to be incorporated by reference is available to the public, the extent that such incorporation is permitted is at the discretion of the Commissioner, provided that such discretion is exercised through the issuance of appropriate rules or regulations.[93] While the court made clear that it favored the use of incorporation by reference, its ruling was such as to permit the Commissioner — if he so desired — to effectively preclude incorporation by reference altogether.

As a consequence of the *General Electric* opinion, the Commissioner

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[91] *Id.* at 1262, 159 U.S.P.Q. at 337.

[92] *Id.* at 1263, 159 U.S.P.Q. at 338.

[93] *Id.*

chose not to adopt this latter approach,[94] but rather published new guidelines[95] with respect to incorporation by reference which were subsequently incorporated into the Manual of Patent Examining Procedure (M.P.E.P.). Currently, these guidelines state in part:

> An application for a patent when filed may incorporate "essential material" by reference to (1) a United States patent or (2) an allowed U.S. application, subject to the conditions set forth below. "Essential material" is defined as that which is necessary to (1) support the claims, or (2) for adequate disclosure of the invention (35 U.S.C. 112). "Essential material" may not be incorporated by reference to (1) patents issued by foreign countries, to (2) nonpatent publications, to (3) a patent or an application which itself incorporates "essential material" by reference or to (4) a foreign application.***
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> Nonessential subject matter may be incorporated by reference to (1) patents issued by the United States or foreign countries, (2) prior filed, commonly owned U.S. applications or (3) nonpatent publications, for purposes of indicating the background of the invention or illustrating the state of the art.[96]

Exploring the Ramifications

Frequently, when the content of a copending application is sought to be incorporated by reference, the copending application does not yet have a serial number assigned. During the period that the guidelines were promulgated, certain examiners refused to permit the serial number and filing date of such an incorporated application to be added on the ground that such amendment constituted the addition of new matter. In *Ex parte Harvey*[97] the board of appeals refused to sustain such a rejection because it deemed there to be a sufficient description of the subject matter of the copending application and its relationship to the application in question to clearly identify it. The board did suggest that it would be desirable for an attorney's docket number to be used for the copending application to more clearly identify it.[98]

The issue reached the C.C.P.A. in 1971 in *In re Fouche*[99] wherein the specification stated that a claimed compound could be "prepared as described in Example I of our application No. ____." No other identification of the referenced application was given. When an attempt

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[94] It was apparently never the intent of the Office to completely proscribe the use of incorporation by reference. Rather, limitations were sought on its use. See the text accompanying note 90, *supra*.

[95] 859 O.G. 346 (Feb. 11, 1969), as amended, 861 O.G. 680 (April 15, 1969).

[96] M.P.E.P. 608.01(p) (Rev. 55, Jan. 1978).

[97] 163 U.S.P.Q. 572 (Bd.App. 1968).

[98] 163 U.S.P.Q. at 573.

[99] 493 F.2d 1237, 169 U.S.P.Q. 429 (1971).

was made later to amend the referring language to "my Application Serial No. 459,921 filed May 17, 1965." the examiner rejected the claims on the basis that this constituted new matter. The serial number sought to be added had not been assigned at the time the application in question was filed. According to the C.C.P.A. the question to be decided was

> ... whether the language "our application No.____," together with the reference to Example I thereof, distinguished the application which later received serial No. 459,921 from all others. If it did, there can of course be no "new matter" problems, since the amendment entering the serial number and filing date would amount to a mere change in wording.[100]

In holding that it did, the court rejected the contentions advanced by the Office that:

> a. The use of the word "our" would suggest that a joint application was intended, and serial No. 459,291 is a sole application.
> b. There is nothing in the referring language which would exclude the possibility that a foreign application was intended.
> c. There is nothing in the referring languge which would exclude the possibility that a later-to-be-filed application was intended.[101]

While acknowledging that the application sought to be referenced was not absolutely distinguished from all other possible applications, the court nonetheless found controlling that (a) it would be unreasonable to read the referring language as pertaining to anything but an earlier or concurrently filed U.S. application; (b) appellant in fact had on file in the Office an application containing enough information to complete the disclosure of the appealed claims; (c) application Serial No. 459,921 did in fact contain an Example I disclosing a method for preparing the claimed compound; and (d) the Office had made no showing that there existed any other application to which the referring language could have pertained.[102]

It is interesting to note the very considerable burden placed on the Office in *Fouche.* In effect, the court assumed prima facie that application Serial No. 459,921 was the application referenced and required the Office to show that it was not.

Within the next two years, the Office took a somewhat different tack in *In re Hawkins.*[103] The only utility set forth in the specification as filed was a statement that the claimed compounds could be used in

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[100] *Id.* at 1239, 169 U.S.P.Q. at 431.

[101] *Id.*

[102] *Id.* at 1239-1240, 169 U.S.P.Q. at 431-432.

[103] 486 F.2d 569, 179 U.S.P.Q. 157 (1973).

the production of valuable monomers in processes described in certain copending British applications described by number. The examiner rejected the claims, stating that "incorporation by the ... British applications (which are unavailable to the public) does not constitute an adequate utility statement."[104] In effect, the examiner argued that the British applications did not conform to the requirement of *General Electric* that the information incorporated by reference be publicly available.[105]

Thereafter Hawkins amended his application to add essentially all of the disclosure of the British applications to his specification. The amendment was made in accordance with the procedure set forth in the M.P.E.P.[106] but was refused entry by the examiner as new matter. The board of appeals acknowledged that Hawkins had acted in accordance with the applicable M.P.E.P. section but held that this section was invalid to the extent that it conflicted with the requirement of 35 U.S.C. §111 that the disclosure be complete at the time of filing.[107] As

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[104] *Id.* at 571, 179 U.S.P.Q. at 159.

[105] See the text accompanying note 93, *supra.*

[106] The pertinent provision of M.P.E.P. 608.01(p) as it then read is set forth at 179 U.S.P.Q. 161 as follows:

> The filing date of any application wherein essential material is incorporated by reference to a foreign patent or to a publication will not be affected because of the presence of such reference. In such a case, *as well as any other case which is not entitled to incorporate essential material by reference,* the applicant will be required to amend the disclosure to include the material incorporated by reference. The amendment must be accompanied by an affidavit or declaration executed by the applicant, or his attorney or agent of record, stating that the amendatory material consists of the same material incorporated by reference in the referencing application. (Emphasis suppled.)

[107] Section 111 provides that:

> Application for patent shall be made by the inventor, except as otherwise provided in this title, in writing to the Commissioner. Such application shall include: (1) a specification as prescribed by section 112 of this title; (2) a drawing as prescribed by section 113 of this title; (3) an oath by the applicant as prescribed by section 115 of this title. The application must be signed by the applicant and accompanied by the fee required by law.

Why the board sought to rely on Section 111 is unclear, especially in view of the statement in *In re Argoudelis,* 434 F.2d 1390, 1392, 168 U.S.P.Q. 99, 101 (C.C.P.A. 1970) that "the reliance of the board on 35 U.S.C. 111 as establishing a general requirement that the specification be enabling as of the filing date is not well founded since that section merely refers to §112 for the requirements concerning the specification."

far as the board was concerned, Section 111 requires material to be incorporated by reference to be available in the Office as of the date of filing. Since the British applications were not so available, the board affirmed the new matter rejection.[108]

The C.C.P.A. refused to accept this position, saying:

> We find first that at least so much of the British applications as dealt with the contemplated utility for the present products in making monomers is *not* new matter within the meaning of 35 U.S.C. 132. It was identified and specifically referred to for that information in the U.S. application *as filed.* Its introduction into the specification was no more the introduction of new matter than the introduction of the application serial number and filing date in In re Fouche, supra.[109]

In so holding, the court stated that an essential requirement of the first paragraph of Section 112, in this case showing of utility sufficient to complete the enablement requirement, need not be present in the specification or available to the public or the Office at the time of filing, provided that the thing needed to complete the disclosure was properly referenced in the application as filed.[110]

Hawkins put the stamp of judicial approval on the Office regulations pertaining to incorporation by reference. It is interesting to note that these regulations, while purporting to prohibit incorporation of essential material by reference to other than an issued U.S. patent or a commonly assigned allowed U.S. application, in point of fact provided no sanction of any type if the incorporation was by reference to some other document. In such a situation, all that was required was for the applicant to amend the specification to add the material incorporated by reference and provide an affidavit or declaration that the added material was in fact that which was incorporated by reference.[111]

One might well ask why, if essential material cannot be incorporated by reference to other than a U.S. patent or a commonly assigned allowed U.S. application, an improper incorporation nonetheless permits an amendment to be made which avoids a new matter rejection under 35 U.S.C. §132. The answer, simply put, is because the C.C.P.A. in *Hawkins* says it does. In so saying, the court placed great reliance on the fact that under the regulations, if the reference had been a foreign patent instead of a foreign application, the Commissioner would not have considered it to be new matter. That being

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[108] 486 F.2d at 572, 179 U.S.P.Q. at 160.

[109] *Id.* at 574, 179 U.S.P.Q. at 162.

[110] *Id.* at 573, 179 U.S.P.Q. at 161.

[111] See note 106, *supra,* and M.P.E.P. 608.01(p) (Rev. 55, Jan. 1978).

the case, as far as the court was concerned there was no difference between a foreign application and a foreign patent, because whether the material was secret, i.e., not publicly available, was irrelevant.[112] It seems to have assumed *arguendo* that it was within the Commissioner's discretion to permit an improper incorporation to be corrected by an amendment which is not subject to a new matter rejection, provided only that it was clear that an incorporation had been intended.

While the applicable section of the M.P.E.P. at that time made no reference whatsoever to foreign applications and thus appeared at first glance to provide no basis for permitting an amendment to overcome an improper incorporation from a foreign application, the court relied on the following emphasized language from the guidelines: "in such a case, *as well as any other case which is not entitled to incorporate essential material by reference,* the applicant will be required to amend the disclosure to include the material incorporated by reference."[113]

Thus, under the rationale of *Hawkins,* it appeared that there was no such thing as a truly uncorrectable improper incorporation by reference, because one presumably could always amend to add the material to the specification if the incorporation was deemed improper. Moreover, in *In re de Seversky*[114] decided some five months before *Hawkins* the C.C.P.A. had indicated that incorporation by reference could be "of matter elsewhere written down (not necessarily in a patent application), for economy, amplification, or clarity of exposition, by means of an incorporating statement clearly identifying the subject matter which is incorporated and where it is to be found."[115] *Hawkins* taken together with *de Seversky* suggested that an improper incorporation citing a laboratory notebook or an internal report could readily be corrected by an amendment inserting the material into the specification of the referencing application.

Whether the Office would permit such remedial action without contending that the amendment constituted new matter is open to question. In this regard it is to be noted that the applicable M.P.E.P. section has been amended since *Hawkins* to make specific reference to foreign applications and to delete the emphasized language relied on

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[112] 179 U.S.P.Q. at 162. Unfortunately, the court did not see fit to offer an adequate explanation of why it was considered irrelevant.

[113] See note 110, *supra.*

[114] 474 F.2d 671, 177 U.S.P.Q. 144 (1973).

[115] *Id.* at 673 177 U.S.P.Q. at 146.

in *Hawkins*.[116] Even so, the C.C.P.A. has since quoted with approval the cited language from *de Seversky*.[117]

Clearly, under the guidelines an examiner is supposed to require an applicant to add the material to his specification by amendment when an improper incorporation of essential material has been made by reference.[118] But what happens if this is not done and the application subsequently issues as a patent containing an improper incorporation by reference? In the only opinion which has been found to consider this point the district court ruled that in such a situation the patentee cannot rely on the improper incorporation by reference to show patent validity.[119]

In the interim between *Fouche* and *Hawkins* the C.C.P.A. had occasion to consider yet another aspect of incorporation by reference. In 1964 the court had held in *In re Fried* that a prior filed, copending application incorporated by reference for a specific purpose could properly be relied on for *all* that it discloses and not merely the specific material set forth in the statement of incorporation.[120] In 1967 the board of appeals without referring to *Fried* held that a rejection under 35 U.S.C. §102 was proper because the cited reference had an incorporation by reference which supplied certain disclosure necessary to support the rejection.[121] Such a holding was necessary because of the general rule that a rejection under 35 U.S.C. §102 is proper only if the claimed subject matter is identically disclosed or described in a *single* prior art reference.[122]

In 1971 in *In re Saunders*[123] the issue of the extent to which incorporation by reference could be used to support a §102 rejection reached the C.C.P.A. Without making any reference to *Fried,* the court took the position that for §102 purposes an incorporation by reference can be used only for that to which it specifically refers.[124] That is to say, if a portion of the disclosure of the reference not specif-

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[116] See M.P.E.P. 608.01(p) (Rev. 55, Jan. 1978).

[117] See *In re Voss,* 557 F.2d 812, 194 U.S.P.Q. 267, 270 (1977).

[118] See M.P.E.P. 608.01(p) (Rev. 55, Jan. 1978).

[119] *Westwood Chemical, Inc. v. Dow Corning Corp.,* U.S.P.Q. 649, 660 (E.D.Mich. 1975).

[120] See note 72, *supra.*

[121] See note 80, *supra.*

[122] See note 81, *supra.*

[123] 444 F.2d 599, 170 U.S.P.Q. 213 (1971).

[124] But the concurring opinion of Judge Baldwin is in line with the view expressed in *Fried. Id.* at 606, 170 U.S.P.Q. at 220-221.

ically referred to in the incorporating statement is required to show obviousness to one of ordinary skill in the art, the two references together simply cannot constitute an "anticipation" in the technical sense of that term in patent law so that a §102 rejection is not proper.[125]

Five months after *Saunders* the board of appeals considered whether a specific incorporation by reference for one purpose, namely, how to make, could also be used for another purpose, i.e., how to use.[126] Both teachings are required in order to meet the enablement requirement of 35 U.S.C. §112. Without making any reference to *Fried, de Seversky,* or *Saunders,* it held that the incorporation was limited to "how to make," and did not include the "how to use" disclosure of the reference. *Lund* was cited in support of the view that "reference to an earlier application does not automatically incorporate by reference all disclosure of the earlier application."[127] While it is questionable whether *Lund* supports this particular interpretation,[128] the fact that it was made clearly indicates that the use of specific rather than general incorporating languge may well serve to limit the incorporation to the specific material set forth, depending on the case law relied upon.

Indeed, the board has taken this exact position without citing any case law to support it.[129] While certain of the language used in *de Seversky* would seem to support this view,[130] it is clearly contrary to *Fried.*

The guidelines put forth by the Commissioner expressly permitted incorporation by reference from a U.S. patent application which had not yet issued.[131] It was not surprising therefore that these regulations soon required interpretation as to whether such an incorporation acted as an exception to the statutory mandate that pending applications must be kept in confidence by the Office.[132] Early in 1973

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[125] *Id.* at 602, 170 U.S.P.Q. at 216-217.

[126] *Ex parte Hagerman,* 179 U.S.P.Q. 747 (1971).

[127] *Id.* at 750.

[128] See the text accompanying notes 74-77, *supra.* The holding in *Lund* appears limited to the view that a mere statement that an application is a continuing application, e.g., a continuation-in-part of a cited parent application, does not serve to incorporate *any* of the disclosure of the parent application by reference.

[129] *Ex parte Mott,* 190 U.S.P.Q. 311, 315 (Bd.App. 1975).

[130] See the text accompanying note 115, *supra.*

[131] See the text accompanying note 96, *supra.*

[132] 35 U.S.C. 122 provides that "applications for patents shall be kept in confidence by the Patent and Trademark Office and no information concerning the same given

the Solicitor's Office issued an opinion in *In re Yang*[133] that (a) an incorporation by reference acts as a waiver of the confidentiality requirement of the statute, (b) such a waiver permits access to the application incorporated by reference in the state that it was in as of the filing date of the issued patent which incorporates it, and (c) an incorporation by reference does not permit access to the prosecution history of the application thus incorporated.[134]

Although the Circuit Court in *General Electric* gave the seal of approval to incorporation by reference, it failed to provide any guidance as to how a proper incorporation by reference was to be achieved. Nor for that matter did the guidelines issued by the Commissioner. While it might reasonably be assumed that incorporation by reference should only be permitted if there is an express statement to that effect, the C.C.P.A. has not adopted such an approach. Rather, in *de Seversky* it emphasized that

> ... the purpose of "incorporation by reference" is to make one document become a part of another document by referring to the former in the latter *in such a manner* that it is apparent that the cited document is part of the referencing document as if it were fully set out therein.[135]

A problem, of course, is ascertaining just what such a manner is.[136] In *de Seversky,* the court made clear that "a mere *reference* to another application, or patent, or publication is not an *incorporation* of anything therein into the application containing such reference for the purposes of the disclosure required by Section 112."[137] It reiterated the position first taken in *Lund* that a statement that an application is a continuation-in-part, or a continuation, or a division, or in part a continuation of another application is not of itself sufficient to act as an incorporation by reference. One conclusion that can be drawn from this is that if there is not adequate evidence that incorporation by reference is intended, an amendment seeking to make the reference into a proper incorporation would be new matter as would any amendment which sought to add disclosure from a reference not prop-

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without authority of the applicant or owner unless necessary to carry out the provisions of any Act of Congress or in such special circumstances as may be determined by the Commissioner."

[133] 177 U.S.P.Q. 88 (P.O.Sol. 1973).

[134] *Id.* at 89.

[135] 474 F.2d 671, 674, 177 U.S.P.Q. 144, 147 (1973).

[136] Fairly recent examples which the C.C.P.A. has deemed to constitute proper incorporating language are given in *In re Voss,* 557 F.2d 812, 194 U.S.P.Q. 267 (1977); and *In re Hughes,* 550 F.2d 1273, 193 U.S.P.Q. 141 (1977).

[137] See note 135, *infra,* at 673, 177 U.S.P.Q. at 146.

erly incorporated. And that in a nutshell was a large part of the difficulty which faced the corporate assignee in *Dart Industries, Inc. v. Banner.*[138]

The *Dart*[138a] opinion came about as a direct result of *de Seversky.* In *de Seversky,* the C.C.P.A. held that a mere statement that an application (B) is a continuation-in-part of an application (A) does not act to incorporate the disclosure of (A) into that of (B). The net result was that a chain of disclosure was held to be broken so that the filing date of (B) could not be used to overcome the date of an intervening reference with respect to a §103 rejection of a daughter application (C). If this sounds confusing, it's because it is. The point to bear in mind is that the critical disclosure was contained in (A) and (C) but not in (B).[139]

In an effort to continue the good fight, a continuing application (D) was then filed, but the board of appeals upheld the same §103 rejection and in addition applied a res judicata rejection.[140] During this same period, the corporate assignee, Dart Industries, filed a reissue application for the patent which had issued on application (B). The purpose of the reissue application was to add the single sentence "The entire disclosure of my patent, 3,053,029 [application (A)] is incorporated herein by reference," which if permitted would restore the chain

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138 200 U.S.P.Q. 656 (D.D.C. 1978).

138a [Footnote added in proof.] The *Dart* decision has recently been reversed by the D.C. Circuit Court of Appeals. See 207 U.S.P.Q. 273 (1980). Specifically, the court stated:

> Attributing deSeversky's failure to satisfy section 120 to a good faith misunderstanding, the district court concluded that Dart's attempt to overcome that failure should not be barred by the new matter prohibition of section 251. We cannot agree. It is true that section 251 is a remedial provision, based on equity and fairness. It is, as it should be, often broadly construed to bail applicants out of unintended and unfortunate situations caused by good faith errors. It cannot, however, be used to permit a violation of its own terms, i.e., to permit an insertion of new matter.
>
> A contrary interpretation of section 120 and section 251's new matter prohibition would open the reissue door to every applicant who, like deSeversky, misunderstood the effect of a mere "continuation-in-part" statement in an application. It would allow applicants to freely circumvent the law as defined in In re deSeversky and in In re Schneider. It would allow applicants to recapture matter properly within the public domain. Whatever effect "good faith" considerations may have in other contexts, they cannot be employed to achieve these results.

139 See note 137, *supra.*

140 200 U.S.P.Q. at 658-659.

of disclosure and effectively remove the §103 rejection of the granddaughter (D). The claims of the reissue application were rejected as being based on a specification containing new matter.[141]

In *Dart* the district court for the District of Columbia was faced with an appeal from the rejection of the claims of the reissue application and of the granddaughter (D). It had little difficulty in finding that if the new matter rejection of the reissue claims was invalid, then res judicata could not apply and the rejection of the claims of the granddaughter (D) would also be invalid.[142] After receiving detailed memoranda on the case law from the Office and Dart Industries, the district court concluded that there were no clear precedents on the new matter issue,[143] and held

> ... that since the patentee here intended to comply with the requirements of §120, and believed in good faith that he had done so, the addition of explicit language which incorporates by reference the disclosure in an earlier application which the patentee intended to incorporate, and believed he had incorporated, is not the addition of new matter barred by §251.[144]

The fallacy in the court's reasoning is that even assuming *arguendo* that the patentee believed in good faith that he had complied with 35 U.S.C. §120, that section of the statute does not provide any proper basis for the court's holding.[145] Rather, the court is confusing two different concepts described by C.C.P.A. as follows:

> (1) the right to have the benefit of the filing date of an earlier application under 120 for subject matter claimed in a later application because that subject matter is *disclosed in an earlier application* to which "a specific reference" is made — i.e., a reference to the earlier application per se, and (2) the incorporation by *reference* in an application of matter elsewhere written down (not necessarily in a patent application), for economy, amp-

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141 35 U.S.C. 251 dealing with reissue of defective patents states in pertinent part: "No new matter shall be introduced into application for reissue."

142 200 U.S.P.Q. at 660, n. 6.

143 *Id.* at 664.

144 *Id.* at 665.

145 According to 35 U.S.C. 120:

> An application for patent for an invention disclosed in the manner provided by the first paragraph of section 112 of this title in an application previously filed in the United States, or as provided by section 363 of this title, by the same inventor shall have the same effect, as to such invention, as though filed on the date of the prior application, if filed before the patenting or abandonment of or termination of proceedings on the first application or on an application similarly entitled to the benefit of the filing date of the first application and if it contains or is amended to contain a specific reference to the earlier filed application.

> lification, or clarity of exposition, by means of an incorporating statement clearly identifying the subject matter which is incorporated and where it is to be found.[146]

Dart is an example of the not uncommon practice in the federal courts of granting rights based on an equitable consideration of what the court perceives a party *intended to do* rather than what he actually did. Whether the C.C.P.A. will adopt the position taken by the district court remains to be seen; however, it too has been known to act on the basis of what was intended rather than what was actually done.[147] Query: Would the result have been the same in *Dart* had the patentee *not* intended to incorporate the entire content of application (A) into application (B)? By the logic of the district court the answer would presumably be "no" even though the action of §120 would be unchanged by this fact.

Conclusion

If asked, most practitioners of patent law would express the view that incorporation by reference is a rather straightforward and static area of patent practice, not at all as complicated as many other parts of this rather esoteric art. While comparatively speaking this may be true, it most certainly is not an absolute as has been shown by the preceding sections of this article. For a doctrine that has been around for three quarters of a century, incorporation by reference still leaves some basic questions unresolved. For example, if an incorporation is made for one purpose, is the incorporation effective for another purpose not specifically set forth? As has been shown, the case law is mixed.

It is apparent that much of the problems which presently exist with respect to incorporation by reference would readily be avoided by the use of express language which incorporates the disclosure of the reference into the specification of the application in question. As a practical matter, an express incorporation should always be of the reference as a whole rather than of a limited part thereof. Needless to say, the Office can save itself and applicants a great deal of trouble and frustration by promulgating a requirement that an incorporation by reference must be expressly stated to be effective. As pointed out by both the D.C. Circuit Court and the C.C.P.A.

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[146] *In re Voss,* 557 F.2d 812, 194 U.S.P.Q. 267, 270 (1977); and *In re de Seversky,* 474 F.2d 671, 674, 177 U.S.P.Q. 144, 146 (1973).

[147] See, e.g., *In re Ehrreich,* 590 F.2d 902, 200 U.S.P.Q. 504 (C.C.P.A. 1979); and Walterschied, "Insufficient Disclosure Rejections (Part III)," 62 J.P.O.S. 261 (1980).

> . . . necessarily the Commissioner of Patents is vested with wide discretion to formulate rules and regulations governing its [incorporation by reference] use, thereby to prevent its abuse.[148]

It remains to be seen whether the Commissioner will in fact revise the applicable section of the Manual of Patent Examining Procedure.

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[148] *In re Hawkins,* 486 F.2d 569, 179 U.S.P.Q. 157, 161 (C.C.P.A. 1973); and *General Electric Co. v. Brenner,* 407 F.2d 1258, 159 U.S.P.Q. 335 (D.C. Cir. 1968).

CURRENT LITERATURE IN LAW/SCIENCE: POLICY AND INTELLECTUAL AND INDUSTRIAL PROPERTY

COMPILED BY THOMAS M. STEELE*
AND JUDITH GIRE NORCROSS**

With the pages that follow this introduction, IDEA begins publication of a current listing of materials in the areas of the law/science interface. This listing will concentrate on materials dealing with intellectual and industrial property and science policy. While every effort is made to furnish complete order information, readers should feel free to contact the compilers for more information. The compilers encourage readers to bring materials of merit, published and unpublished, to their attention.

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COMMENTARY

A "Piece of the Action?"

At the ABA convention last summer in Honolulu, I gave a paper entitled "Rights of Employed Inventors in the United States" which focused on the question of whether legislation requiring employers to reward their inventors would on the whole be beneficial or not. This type of legislation has been passed in most of the major industrialized countries of the world, including those of the Communist Bloc.

In researching my paper I found there was an extreme dearth of any meaningful statistical data on the subject and that most people, both pro and con, were simply giving their gut reaction to the psychological and economic factors involved.

To my way of thinking, there is a segment of employed inventors in the United States that will invent regardless of whether it is given adequate incentives or not. It is in their blood and they are going to invent just as they are going to eat and sleep. There is another segment of employed inventors that probably will not or cannot invent in any meaningful way regardless of the incentives that are given it whether in the nature of fame or fortune. Some people, I believe, simply are not creative. In between these two extremes there exists a segment of inventors of unknown size that is subject to motivation and which is likely to concentrate more efforts on creativity and producing inventions if it is properly stimulated. Within this group there are many who are probably already adequately motivated and are doing about as much as they can do; but I believe there exists a great number which, if given the stimulation of a "piece of the action", would produce more worthwhile inventions for their employers and the country.

On the other hand, there are serious drawbacks to legislating and requiring employers to share licensing royalties, for example, with the inventors. Probably the most often enunciated problems deal with the potential of increased secrecy and therefore decreased communication between fellow employees, and the possibility that if employers cannot be sure that they will obtain title to inventions, they may reduce their R&D effort.

It seems to me that the question is not answerable with presently known information and will require the work of industrial

psychologists, polling of inventors and employers, and a great deal of statistical work as a follow-up. While the effort may be a large one, it seems to me that it is well worth tackling by someone considering the overall effect that it could have on our nation's well being.

I have been serving on an advisory panel of the Office of Technology Assessment which is studying the question of the effect of patents on innovation in the United States, and have been urging OTA to undertake such a project. However, due to constraints of time and money I do not believe that OTA will be able to do anything more than highlight the fact that such an effort might be worthwhile.

The purpose of this communication is to generate interest in undertaking such a project, and to volunteer my assistance if I can in any way be of help.

David. S. Urey
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On Diamond v. Diehr and Lutton

Finding out that the Supreme Court has decided in favor of your client, especially when it's your first case before the Court, is a milestone I will always remember. The decision to which I refer is in *Diamond v. Diehr and Lutton*;* it was handed down on Tuesday, March 3, 1981, holding 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." (Majority at page 11.) The patent application and the case for respondents was handled by Owen, Wickersham & Erickson, of San Francisco, with which I am an associate; that's how a 1979 Franklin Pierce Law Center graduate was lucky enough to help work on *Diehr.*

I was sitting at my desk early on Tuesday morning, sorting out where things had ended on Monday and would begin that day, when one of the partners, David Harrison, came into my office and asked me "Have you heard?"; the reply was "Heard what?" Dave's smile should have told me, but, it didn't. "Bob's (Robert E. Wickersham) won his case in the Supreme Court!" Dave had heard the news on the radio that morning on his way to the office.

The news spread very quickly through the office, and excitement began to build. This was a case that everyone had participated in, in one way or another, so a shared feeling of triumph and pride prevailed.

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*101 Sup. Ct. 1048, 209 U.S.P.Q. 1 (1981).

We were all waiting for the man of the hour to arrive; Robert had heard about the decision on the news early in the morning, and arrived to our joyous reception looking and feeling like the conquering hero. (Robert was primarily responsible for the case, and had made the oral argument in Washington.) With the felicitations accomplished, now there was time to start making calls to friends and colleagues to give them the early scoop on the latest Supreme Court decision. Of course, one of the calls had to be to the Law Center, to let Bob Shaw and the IDEA staff be among the first to hear the news. Bob thought that this was the sort of news that would fit into a commentary article, which is the reason for the present effort. The setting now set, it's time to review the opinion.

The majority opinion was written by Justice Renhquist, who was joined by Chief Justice Burger and Justices Stewart, White and Powell; it spans seventeen pages. The twenty-seven page dissent was authored by Justice Stevens, joined by Justices Brennan, Marshall, and Blackmun. Interestingly enough, Justices White and Powell switched sides with Justices Blackmun and Stevens on the question of patentability between the decisions in *Chakrabarty* and *Diehr*.

Affirming the opinion of the Court of Customs and Patent Appeals, (reported at 602 F.2d 982), the majority stated the question to be:

> 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 USC §101. (Majority at page 1.)

Its opinion is divided into four parts: a history of the PTO proceedings, an analysis of the existing law on patentability of a process, the effect of computer technology on questions of patentability, and a conclusion.

The claimed invention involves a process for curing precision molded rubber parts, particularly oil seals. The process solved the long-standing problem in the industry of routine overcuring products to assure that all the parts being molded were at least cured for the minimum necessary time. This resulted in two specific problems: first, that the oil seals were being overcured, and second, that the molds were not being used at maximum efficiency. The respondents' process solved both of these problems by enabling products to be withdrawn at precisely the proper moment, thereby maximizing the efficiency of all molds to the extent that production was increased by 20 percent with savings of 25 million dollars over the past six years.

The process of the application involves constantly monitoring temperature at a location near the part being molded and recalculating, at frequent intervals, the Arrhenius equation (which determines proper

cure time). A representative claim would be claim 11, which reads as follows:

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 predetermined rubber curing temperature,

(b) installing prepared unmolded synthetic rubber of a known compound in a molding cavity of a 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.

Part I, the historical review of the patentability of processes, began with reference to *Chakrabarty* where the Court had recently described the purpose of the patent laws and the scope in which Section 101 should be construed. Processes had originally been lumped into the category of "useful arts" in the Patent Act of 1793. It was not until the 1952 Act that the term "process" was formally added to the patent laws. The Court referred to the case *Corning v. Burden* (15 How. 252 (1853)) to show one of its earliest treatments of the patentability of a process. "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." (Id. at 268) The court then referred to the treatment of processes from *Cochrane v. Deener* (94 U.S. 780 (1876)) as it was more recently quoted in *Gottschalk v. Benson* (409 U.S. 663 (1972)), where the following was added to the definition of a patentable process: "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." (Id. at 70) The respondents transformation of an article from one state to another was said to be the type of process which has been historically eligible for protection under the patent laws.

Addressing the effect of including a computer in the claims, the Court reiterated the long standing prohibition against granting patents for laws of nature, physical phenomena, and abstract ideas *(Parker v. Flook)*. The earlier computer-patent cases were reviewed, including *Gottschalk v. Benson's* definition of an algorithm as "a procedure for solving a given type of mathematical problem" which could not be the sole subject of a patent. *Flook* was distinguished from the present case because it involved simply a method for computing an updated alarm limit, a number, and did not even involve the means for setting off the alarm itself. Respondents claims were also differentiated because they do not preempt the use of an equation itself. The combination of a computer with the other steps of the process took the present claims out from the prohibition against patenting simply abstract ideas and formulas. Sticking with the presented question, the Court concluded:

> 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 Section 101. (Majority at page 12.)

It is this rejection of the argument that any patent claim involving a programmed digital computer is unpatentable under Section 101 for which *Diamond v. Diehr and Lutton* will most likely be remembered.

That is not, however, the entire import of the opinion. Petitioner had argued that Section 101 should be applied only to those elements of the claims which are at the point of novelty. Therefore, they argued, since the steps of inserting rubber into the mold, etc. were all known in the art, all that remained at the point of novelty was the use of a computer program. Their conclusion was that all the applicants tried to patent was the equation itself. The Court rejected this argument that claims must be dissected into individual components and then analyzed for novelty, finally separating out the point of novelty for Section 101 analysis, holding:

> In determining the eligibility of respondents' claimed process for patent protection under Section 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. (Majority at page 13.)

This requirement of considering the claims *as a whole* is consistent with the Court's earlier definition of a patentable process, because it was the overall effect of the process in transforming matter from one state to another that made it fall within the bounds of statutory subject matter under Section 101 in the first place, not the effect of any particular step of that process.

The Court further concluded that despite the presence of the language "any new and useful" in Section 101, the legislative history of the Patent Act makes clear the fact that the determination of novelty is exclusively controlled by Section 102, and is totally separate from Section 101.

> The "novelty" of any element or steps in a process, or even of the 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. (Majority at page 13.)

In its conclusion, the majority stated that in analyzing a claim involving a mathematical formula or use of a computer, " . . . an inquiry must be made into whether the claim is seeking patent protection for that formula in the abstract." (Majority at page 15.) For example, in *Flook* the formula was claimed for all possible uses in catalytic conversion. In *Diehr,* however, the claims were limited to the formula as it

was used in one particular process for curing precision molded rubber parts:

> ... 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. (Majority at pages 16-17.)

The arguments of the dissent were addressed by the majority in footnote 15. The difference between the sides was that the dissent saw the claims as presenting nothing more than a time calculation method, whereas the majority saw the claims as an entire process which produces an end product. They concluded by stating:

> 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 patent protection even though some or all of its elements are not "novel". (Majority at page 17.)

The dissent was indeed a strong one; it differed from the majority primarily in its interpretation of the claims in question and the proper procedure for their evaluation. This is why *Diamond v. Diehr and Lutton* will be remembered, not only as the first Supreme Court case holding a patent claim that incorporated a programmed computer as patentable subject matter, but as a case which prescribed the manner in which claims must be analyzed to determine patentability under 35 U.S.C. §101.

The dissent began with its own review of the history of the U.S. patent law and its treatment of computers. Reaching back, reference was made to the "mental steps" doctrine, which denied patentability to processes involving mental operations. The dissent said that this is the same doctrine which denied patentability to mere ideas, mathematical formula, or methods of computation. The *Cochrane v. Deener (supra)* definition of patentable processes, requiring the physical transformation of materials, was repeated.

Turning to more modern times, the conclusion of the President's Commission on the Patent System of 1965 that computer programs be expressly excluded from patent coverage was made the starting point for the dissent's discussion of how the patent laws have (or should have) handled computer related applications. The 1968 PTO guidelines for examination of applications for patents on computer programs (denying patentability) were referred to, as well as the shortened life of these guidelines due to the decisions of the CCPA in *In re*

Tarczy-Hornoch (397 F.2d 856 (CCPA 1968)) (overruling the "function of a machine" doctrine) and *In re Prater* (415 F.2d 1378 (CCPA 1968), modified on rehearing 415 F.2d 1393 (CCPA 1969)), where the "mental steps" doctrine was put to rest as based on what the CCPA said were poorly reasoned precedents. The dissent next pointed to what it termed the CCPA's extension of patent protection for computer programs where the patent claims were drafted in apparatus form in *In re Bernhart,* (417 F.2d 1395 (CCPA 1969)). That line continued through *In re Musgrave* (431 F.2d 882 (CCPA 1970)) and *In re Benson* (441 F.2d 682 (CCPA 1971)) where the CCPA's holdings were "extended" to include "computers, regardless of the uses to which they are put" (Id. at 688) for patentability under Section 101.

This was later reversed by the Court in *Gottschalk v. Benson,* (409 U.S. 63 (1972)) holding that "new mathematical procedures that can be conducted in old computers, like mental processes and abstract intellectual concepts, . . ., are not patentable processes within the meaning of §101" (see Id. at 67). *Gottschalk v. Benson* was said to have been gradually whittled away in *In re Johnston* (dealing with a record keeping machine — patentable since *Benson* involved only processes, not apparatus claims). Then, in *In re Knoll* and in *In re Chatfield,* the *Benson* preemption was further narrowed to claims which only preempt all uses of an algorithm or mathematical formula.

They then expounded on the three part decision in *Parker v. Flook,* which they said held: first, that wholly preempting an algorithm is not the test; second, that improved methods of calculation are not patentable, even as part of a physical process; and third, that the algorithm be treated as old for Section 101 purposes and the claims then be examined to determine whether they disclose some other inventive concept. The dissent pointed to CCPA's supposed failure to follow these guidelines.

Next came an analysis of the claims at issue, which differed significantly from that of the majority. All that the dissent saw in the claims was "an improved method of calculating the time that the mold should remain closed during the curing process." (Dissent at page 14.) Three reasons were given as to why the Court improperly concluded that the claimed invention covered a patentable method: first, that there was nothing unusual about the temperature-reading devices used; second, that devices for constantly measuring temperature were well known; and third, that only the steps in the claims which relate to the calculation were different from the conventional methods of operating a molding press. They felt that all that the inventors had discovered was a new method of using a digital computer to calculate

time. The change of state from the starting material to the finished product was not addressed, instead the recalculation of cure time was analogized to the method of updating alarm limits from *Parker v. Flook*. In fact, the dissenters indicated a belief that the discovery in *Flook* was somewhat more complex than the present invention. Justice Steven's disagreement with the majority opinion was that it evidenced "a misunderstanding of the applicants' claimed invention and a failure to recognize the critical difference between the 'discovery' requirement in Section 101 and the 'novelty' requirement in Section 102." (Dissent at page 18.)

Part three turned to the "proper" manner of analyzing claims and the question of whether novelty should be looked into for Section 101. "Proper analysis, therefore, must start with an understanding of what the inventor has claimed to have discovered — or phrased somewhat differently — what he considers his inventive concept to be." (Dissent at page 19) The dissenters saw the present invention as the development of a new method of programming a computer, not a new process for molding precision rubber parts. Based on that understanding, the method was regarded as solely an algorithm, which in the absence of another inventive concept is unpatentable.

Comparing the present invention to *Flook,* the dissent pointed out that both claims involved the solution of an equation and some post solution activity. Setting off an alarm limit at the appropriate time was viewed as equally important to the catalytic conversion process of *Flook* as triggering the mold opening device in the synthetic rubber curing process of the present invention. However, no mention was given to the fact that opening of the press in the present invention is an actual physical event, whereas, the setting of an alarm limit is not. Perhaps the result would have been different had the alarm limit in Flook been connected to automatic means for adjusting the reaction parameters to halt the catalytic conversion process. The dissenters agreed that the post solution activity was important in both processes, but believed that it should have no legal significance. This treatment of post solution activity was said to be covered in the holding of *Gottschalk v. Benson,* concluding that under that test the present claims should have been unpatentable.

Finally, the dissent addressed the policy considerations involved in the patentability of computer programs, expressing a preference for deferring to Congress for an answer rather than determine the answer themselves. The computer software industry's remarkable growth in recent years was cited to counter the argument that protection was needed to encourage the industry. The fact that former litigants

Gottschalk, Dann, Parker and Diamond were each serving as Commissioner of Patents and Trademarks when they opposed the availability of patent protection for a program related invention was interpreted as concern by the Patent and Trademark Office as a whole that computer programs remain unpatentable.

The bottom line for the dissent was their concern that patent lawyers be able to accurately determine which, if any, program related inventions are patentable, and a fear that since most processes can be described as an algorithm, they may all be declared unpatentable. Their proposed solution is:

> (1) an unequivocable holding that no program-related invention is a patentable process under Section 101 unless it makes a contribution to the art that is not dependent entirely on the utilization of a computer, and (2) an unequivocable explanation that the term "algorithm" as used in this case, as in *Benson & Flook* is synonomous with the term "computer program".

Diamond v. Diehr and Lutton is the first case in which a process involving the use of a programmed digital computer was held patentable by the Supreme Court. I expect the case to be remembered for the following three propositions: first, that a process is not unpatentable simply because it involves the use of a programmed digital computer; second, that in evaluating the patentabilty of an applicant's claims, those claims must be considered as a whole; and third, that the words "new and useful" do not invoke any novelty analysis in determining whether claims fall in the category of patentable subject matter set forth in Section 101.

In conclusion, taking *Diamond v. Diehr and Lutton* in conjunction with the more recent deadlock in *Diamond v. Bradley and Franklin,* there has been an indication of the beginning of a new phase in the development of the United States patent system, in which it will be used to protect many of the computer-related inventions that are rapidly becoming more and more a part of our daily lives. What remains is an effort to make the United States patent system an effective tool for the protection of such inventions. To accomplish that goal will require speeding up the application process (whether by rule change or by increased staff size), so that the patents which issue as a result of these decisions will be effective during the useful life of the inventions which they cover, and will not be first coming into effect after the inventions have become antiquated, as is the current problem for the fast developing computer software industry.

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PATENTABILITY IN THE UNITED STATES OF MICROORGANISMS, PROCESSES UTILIZING MICROORGANISMS, PRODUCTS PRODUCED BY MICROORGANISMS AND MICROORGANISM MUTATIONAL AND GENETIC MODIFICATION TECHNIQUES*

WADDELL A. BIGGART**

I. BACKGROUND

Numerous U.S. patents have issued containing claims directed to processes utilizing microorganisms, for example, to inventions using fermentation processes, to inventions for producing chemical materials such as antibiotics and to inventions for removing environmental pollutants.[1] Such processes clearly fall within the scope of the term "process" as used in 35 U.S.C. §101.[2] Until recently, the United

**Partner; Sughrue, Mion, Zinn, Macpeak & Seas, Washington, D.C. The author thanks Stephen A. Bent for assistance in preparing this article.

[1] The U.S. Patent and Trademark Office has long classified art relating to inventions of these types. Present classifications include Class 210-"Liquid Purification or Separation", Class 424-"Drug, Bio-Affecting and Body Treating Compositions" and Class 435-"Chemistry: Molecular Biology and Microbiology".

[2] 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.

States Patent and Trademark Office (PTO) had routinely rejected claims to microorganisms per se on the basis that a microorganism was not within one of the statutory classes of subject matter as set forth in 35 U.S.C. §101 for which a United States patent could be granted. The Supreme Court decision in the recent case of *Diamond v. Chakrabarty*[3], which is considered a landmark U.S. Supreme Court decision on the patentability of microorganisms, means that now the PTO cannot, at least with respect to genetically engineered microorganisms, reject such as being non-statutory and outside the statutory classes provided for in 35 U.S.C. §101.

However, even though *Chakrabarty* was decided in 1980, it must be noted that U.S. patents containing claims effectively providing coverage for living microorganisms as such, in addition to processes utilizing living microorganisms, have been granted by the United States Patent Office for many years. For example, Pasteur, in U.S. Patent 141,072,[4] was granted claims in 1873 to yeast cells "free from organic germs", and patent claims have issued more recently on food products containing lactic acid bacilli and on lactobacteria in combination with culture media and various other substances.[5] Product claims to an

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[3] *Diamond v. Chakrabarty,* 447 U.S. 303, 100 S.Ct. 2204, 206 U.S.P.Q. 193 (1980).

[4] Pasteur in U.S., Patent 141,072 was granted claims which read

> 2. Yeast, free from organic germs of disease, as an article of manufacture.

[5] U.S. Patent 1,120,330 contains claims of the following format:

> 1. The medicated food product comprising a frozen confection containing a culture of lactic acid bacilli, the said culture being mixed with the ingredients of the confection before the freezing of the latter.

U.S. Patent 1,260,899 contains a claim of the format:

> 5. A compound of lactic acid producing bacteria and inert material made substantially dry and reduced to powdered condition, and incorporated in a neutral air and moisture excluding substance, insoluble in water, having a lower melting point than the temperature of the human body, and inert to gastric acid and body fluids, substantially as herein set forth.

as well as a claim of the format:

> 6. A compound of lactic acid producing bacteria and inert material, made substantially dry and reduced to powdered condition, and incorporated in petrolatum; substantially as herein set forth.

U.S. Patent 1,540,951 contains claims of the format:

> 6. A new article of production, comprising a lactobacillus mass, containing the required number of *B. acidophilus* to the dose of lactobacillus milk and a culture media of smaller volume than lactobacillus milk.

insecticide made of living bacterial cells in a carrier medium, to a "bacterial mosquito larva-killing agent" comprising spores of a particular bacterial strain in a carrier, and to poultry medicine comprising a diluent in admixture with cells of *Scopulariopsis* bacteria have also issued by the PTO.[6]

Prior to *Chakrabarty* when the invention lay in the nature of the microorganism utilized, it was necessary that the microorganism be claimed in combination with "an inert carrier".[7] Thus, prior to

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10. A new article of production, comprised of lactobacillus mass in a moist state and gelatin.

U.S. Patent 1,758,937 contains claims of the format:

1. A new product comprising an oil emulsion containing viable lactobacteria and a culture medium therefor, suspended in the emulsion.

2. A new product comprising an oil emulsion containing viable lactobacteria and lactose, suspended in the emulsion.

3. A new product comprising an oil emulsion containing a pure composite culture of viable lactobacteria, chiefly *B. acidophilus* and *B. bifidus* and *B. bulgaricus*.

[6] U.S. Patent 3,642,982 contains claims of the format:

1. An insecticidal composition containing living bacteria consisting essentially of an inert insecticidal carrier and *Serratia piscatorum* ATCC No. 17999 or *Streptococcus faecalis* ATCC Nos. 15335, 14336 and 19000, the living bacterium being present in an amount of 0.5 to 5 weight percent.

2. An insecticidal composition according to claim 1, wherein the carrier is the culture medium in which the bacterium was grown.

3. An insecticidal composition according to claim 1, wherein the carrier is the dried culture medium in which the bacterium was grown.

U.S. Patent 3,651,215 contains claims of the format:

1. A bacterial mosquito larva-killing agent comprising an effective mosquito larva-killing amount of spores of *Bacillus cereus* var. *juroi* ATCC 21281 as an active ingredient and a carrier.

U.S. Patent 3,683,068 contains claims of the format:

1. A composition of matter for controlling hemorrhagic syndrome in poultry comprising an innocuous and antimycotoxic strain of *Scopulariopsis brevicaulis* (Sacc.) Bainier, distributed in a substantially sterile substratum capable of supporting the growth of said fungus in combination with a finely-divided, substantially fungus-free alkaline diluent, the fungus and substratum being present in the diluent in an amount up to 5 percent by weight.

[7] Although in the *Chakrabarty* decision, the claims considered by the PTO were directed to the microorganism per se, claims had already been allowed by the PTO on a method of use of the *Chakrabarty* microorganism in cleaning up oil spills, on the *Chakrabarty* microorganism in combination with an inert carrier such as straw,

Chakrabarty, a patent application claim directed to a microorganism faced a rejection from the PTO that such a claim was non-statutory on the basis of case law which reasonably suggested by way of dicta[8] that microorganism claims were not allowable.

However, *Chakrabarty* and a companion case, *In re Bergy*[9], have effected a substantial clarification of the law pertaining to patents on microorganisms per se in the U.S. The Supreme Court in *Chakrabarty* held for the first time that claims to compositions of *living matter* constitute statutory subject matter under 35 U.S.C. §101. Moreover, the Court of Customs and Patent Appeals (CCPA) held in *Bergy* that claims to a "biologically pure culture"[10] of a known microorganism are allowable when such a "pure" culture does not exist in nature. The patentability of microorganisms in the U.S. is believed to be quite important to protecting the rapidly developing technology involving microorganisms, particularly those microorganisms which are developed using genetic engineering techniques.

Now that microorganisms and processes utilizing microorganisms cannot be rejected as non-statutory, under 35 U.S.C. §101, it is necessary to consider the disclosure needed in a U.S. patent application to support claims to a process utilizing a microorganism or the microorganism per se to maximize the chances of success in obtaining valid

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allowing the organism to be dispersed in the area of the oil spill, and on the genetic engineering process involved in producing the man-made *Chakrabarty* microorganism.

[8] For example, in *Guaranty Trust Co. of New York v. Union Solvents Corp.,* 54 F.2d 400, 12 U.S.P.Q. 47 (D.Del. 1931), the District Court hearing an infringement action sustained a patent claim directed to a method for producing acetone and butyl alcohol by use of a particular bacterium. In dictum, however, the Court stated:

> Lastly, the defendant contends that the invention of the Weizmann patent is unpatentable since it is for the life process of a living organism. *Were the patent for bacteria per se, a different situation would be presented.* 54 F.2d at 410.

Similarly, in *In re Mancy,* 499 F.2d 1289, 182 U.S.P.Q. 303 (CCPA 1974), which concerned claims to a process for producing a specific antibiotic in which a microorganism not found in nature was employed, the Court stated:

> Here appellants not only have not allowed claims to the novel strain [of microorganisms] used in the process but would, we presume (without deciding), be unable to obtain such a claim because the strain, while new in the sense that it is not shown by art of record, is, as we understand it, a "product of nature". 499 F.2d at 1294.

[9] *In re Bergy,* 596 F.2d 952, 201 U.S.P.Q. 352 (CCPA 1979).

[10] But see IIIA2, *infra.*

claims in an application and to minimize prosecution difficulties when such claims are examined in the PTO.

II. U.S. PATENT APPLICATION DISCLOSURE FOR INVENTION LYING IN MICROORGANISM, ITS DEVELOPMENT OR USE

A. The Written Description in a U.S. Patent Application Specification

35 U.S.C. §112 sets forth the requirements of disclosure necessary to support patent claims in the United States and the requirements for patent claims in the United States.[11]

In order to comply with the requirements of 35 U.S.C. §112 in terms of the written description of the invention, how to make and how to use the invention, and the best mode since the microorganism employed is an essential part of the invention, it is suggested that the specification of the application contain a detailed description of the nature of the microorganism and how the microorganism is to be used, along with the results obtained in use of the microorganism. The nature of and extent of description of the microorganism will depend on whether the microorganism is a known microorganism well-characterized and readily available or whether the microorganism is unknown, i.e., newly isolated from the environment or newly developed by man by mutation, genetic engineering, etc.

For a known, well-characterized microorganism, it is generally sufficient to set forth that the microorganism is known, generally describe its characteristics and include reference to its characterization in the literature and/or the patent art. However, if the microorganism is newly isolated or novel and man-made, in addition to the requirements for deposition of a sample of the microorganism discussed in greater detail below, the specification should contain the following description:

(A) A characterization of the microorganism by genus and

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[11] 35 U.S.C. §112 provides in the first and second paragraphs:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor for carrying out his invention.
>
> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

species, or the genus and species which the microorganism most closely resembles.

(B) A description of how the organism was obtained, the location where the microorganism was isolated and for a novel man-made microorganism, whether such is a mutant strain or a genetically engineered microorganism, and how the "modification" of the microorganism was achieved. If the microorganism is a mutant strain, the parent strain from which the mutant was developed and whether the mutation was achieved by use of chemical mutagens and/or physical techniques should be included. When the microorganism is genetically engineered using recombinant DNA techniques, a description of the genetic alteration techniques employed should be included.

(C) A morphological description of the organism including the shape of the cells, the nature of colonies formed and their behavior on various media, sporulation characteristics, presence or absence of the formation of diffusible pigments and the generation of any odors which might emanate upon culturing should be included.

(D) Metabolic characteristics of the microorganism should be described including the ability to utilize various types of carbon-containing compounds for growth. Typically, this will include a description of the ability of the microorganism to utilize various carbohydrate and sugar derivative sources, organic acid, dicarboxylic acid and hydroxy acid sources, alcohol, polyhydric alcohol and glycol sources, aliphatic amino acids and other nitrogenous compounds, etc., as sources of assimilable carbon. Further, the ability of the microorganism to utilize various nitrogenous compounds as a nitrogen source should be included.

(E) When appropriate, resistance to antibiotics and ability to grow in the presence of antibiotics as well as ability of the microorganism to grow in the presence of various heavy metals should be included when appropriate.

(F) Appropriate conditions for growth such as hospitable temperature growth range, the necessity for the pres-

> ence of vitamins, minerals, trace elements, growth factors, and the like additionally for growth could be desirably included. Also, whether the microorganism will grow under aerobic and/or anaerobic conditions would be desirable to include.

U.S. Patent 4,199,444, directed to a process for decolorizing pulp and paper mill waste water utilizing a novel *Pseudomonas aeruginosa,* contains a disclosure as to this novel microorganism which was considered by the PTO to be sufficient for the purposes of 35 U.S.C. §112, first paragraph.

Obviously, the nature of the disclosure necessary to meet the requirements of 35 U.S.C. §112 will vary depending upon the nature of the microorganism itself and its use. The above provides a background as to the type of disclosure that could be considered for a novel mutant microorganism.

The above suggested disclosure for microorganism applications in the United States is considered necessary even if claims to the microorganism per se are not included in the application. For example, when a novel microorganism is employed in a novel process, even though claims only to the process are included in the application, disclosure as to the microorganism per se as suggested above is considered essential since the novel microorganism is an essential element in the novel process. When using a known microorganism, whose characteristics are well documented in the literature and patent art, again, the disclosure suggested above need not be as detailed. The reason for this, of course, is that the microorganism, even though involved in a novel process, is a known organism whose characteristics are well documented in the art and it is not necessary in a patent application in the United States to set forth in great detail what is already known to one skilled in the art.

When the microorganisms, known or novel, are employed in a process to produce a product, for example, an amino acid, an antibiotic substance, or other chemical material, the disclosure in the specification of a U.S. patent application should also include a description of how the microorganism is employed to achieve the result obtained. More specifically, appropriate disclosure would include necessary or desirable processing parameters, any starting materials employed, and the like. For example, the disclosure would include the substrate acted upon by the microorganism to produce the product obtained. If the substrate can be carbon sources of various types, disclosure of representative examples of such carbon sources upon which the micro-

organism can act should be included. Additionally, just as was the situation discussed above, if the microorganism requires the presence additionally of sources of nitrogen, phosphorus, trace metals, vitamins, amino acids, etc., which might not be present in the substrate medium, disclosure of suitable sources of these materials is desirable. Also, when appropriate, disclosure of amounts of these materials which can be used should be included. Further, the basic nature of the substrate medium, whether solid, liquid, etc., should be set forth.

It is often desirable to set forth how the microorganism is contacted with the substrate utilized by the microorganism in terms of whether such is contacted with a solid medium, suspended or dispersed in a liquid medium, etc., and additionally whether agitation is required or desirable. Conditions under which the microorganism can act including disclosure of aerobic conditions achieved by, for example, bubbling oxygen through mixture or ensuring in some way that a minimum oxygen concentration is achieved is considered desirable. If under anaerobic conditions, the disclosure should set forth maximum oxygen concentrations appropriate to achieve suitable anaerobic conditions. It is desirable to set this forth in the event it is not necessary to exclude oxygen yet oxygen is not affirmatively required in the system. In the case of a microbial process involving, for example, an activated sludge system, since increasing the contact area between the substrate and the microorganisms is generally an important consideration to achieve improved through-put, again disclosure of appropriate techniques and systems whereby enhanced microorganism contact is achieved with the substrate is desirable. Temperature ranges for growth of the microorganism are also considered necessary disclosure.

Basically, it can be said that just as with any invention lying in a chemical process, inventions lying in the utilization of a microorganism in a process should contain disclosure as to appropriate processing parameters, necessary or desirable, to achieve the end result of the process.

When the microbiological process is utilized to produce a known product such as ethanol, various amino acids, proteins and the like, having a known utility, simple disclosure of the end product of the microorganism process is sufficient to meet the requirements of 35 U.S.C. §101 as to utility. However, when a novel and perhaps complex chemical material is produced, for which the utility may not be known, it is necessary to disclose not only the characteristics of the product produced to the extent possible, viewing the technical state of the art in characterizing such a chemical material, but also to set forth uses for the novel chemical material.

This is particularly the case where the complex chemical material is a biologically active compound such as an antibiotic. Disclosure of data obtained in utilization of the antibiotic compound in at least *in vitro* testing is required to demonstrate the utility of such an antibiotic compound. In general, for antibiotic materials, it is sufficient to disclose *in vitro* test results against a series of known microorganisms. For an antibiotic compound, unless the utility of the antibiotic compound is solely *in vivo,* in general *in vitro* test results are sufficient. For *in vivo* uses, particularly those which are not recognizably correlatable with *in vitro* test results, inclusion of clinical results on animals or humans is considered essential. When a particular method of *in vivo* administration of the antibiotic is necessary or when a specific *in vivo* dosage range has been found to provide the useful results obtained, disclosure of methods of administration and forms of administration as well as appropriate dosage ranges is also considered to be essential, particularly when a novel chemical material is unique or its method of use is unique and is claimed in the application.

As far as the chemical material itself is concerned, a description of the chemical material, to the extent technically possible, in terms of structure or chemical and physical properties should be set forth. Such description can include elemental analysis results, IR, UV and NMR spectra, determinations on whether the material is acidic and basic or neutral, isoelectric point determinations, melting point characterizations, physical form and color, and any biological activity determinations indicative of structure or functional group presence.

Disclosure as suggested above will in general also be sufficient to meet the best mode requirement of the first paragraph of 35 U.S.C. §112.

The disclosure suggested above for inclusion in the specification of an application involving a microorganism invention, whether the novel microorganism is claimed, whether the microbical process utilizing a known or novel microorganism is claimed and/or whether a novel product produced by the microorganism is claimed, should be considered in determining the sufficiency of disclosure and whether such would be considered technically and legally to meet the requirements of 35 U.S.C. §112, first paragraph. It must be recognized that the disclosure of the specification must be considered in relation to the nature of the microorganism, whether known or novel, the microorganism process and the product produced. Depending upon the situation, some of the disclosure suggested above may or may not be appropriate; the suggestions are merely given for guidance as to the type of disclosure which should be considered in a microorganism

invention. Although specifics have been suggested they are intended to be merely representative.

B. Deposition of Microorganism Sample as Prerequisite to Obtaining Microorganism Patent

Under the first paragraph of 35 U.S.C. §112, an applicant for a U.S. patent must provide a written description in his application that is adequate for any person skilled in the relevant art to understand, and to make and use the invention. When the invention involves a microorganism, however, even the detailed written disclosure as suggested above may not completely suffice to place the invention in the hands of those skilled in the art once the application issues as a U.S. patent *unless* the microorganism in question was already known or otherwise readily available to the public.[12] Consequently, prior to 1970, the PTO required all applicants with claims involving microorganisms which were not known or available to the public first to deposit a culture of the microorganism in a depository to which the public had free access *as of the date of filing* the application, citing the first paragraph of 35 U.S.C. §112 as statutory basis for this requirement.

However, in the case of *In re Argoudelis,* 434 F.2d 1390, 168 U.S.P.Q. 99 (CCPA 1970), the CCPA held that the first paragraph of 35 U.S.C. §112 does not require that the microorganism culture deposited by an applicant with a public depository be available to the general public at the time of filing his U.S. patent application. The CCPA in *Argoudelis* concluded that restrictions on access to the deposited culture by the public need be removed only upon the *granting* of a U.S. patent to the applicant. On the basis of the decision in *Argoudelis,* the PTO established a procedure for the deposition of microorganisms, set forth at

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[12] An applicant seeking claims to a bacterium per se unsuccessfully attempted to circumvent the disclosure requirements of 35 U.S.C. §112 by claiming under the Plant Patent Act of 1930, incorporated in the present U.S. Patent Statute as 35 U.S.C. §§161-163. Specifically, 35 U.S.C. §162 states:

> No plant patent shall be declared invalid for noncompliance with section 112 of this title if the description is as complete as is reasonably possible.
>
> The claim in the specification shall be in formal terms to the plant shown and described.

However, in *In re Arzberger,* 112 F.2d 834, 46 U.S.P.Q. 32 (CCPA 1940), the CCPA held that bacteria are not plants as the common man generally used this term and thus such were not within the meaning of the 1930 Plant Patent Act. The *Arzberger* decision has been criticized as promulgating an unduly narrow interpretation of the word "plant" with regard to the 1930 Act.

886 O.G. 638 (May 25, 1971) and at §608.01(p) of the Manual of Patent Examining Procedure. The PTO guidelines for deposit do not recite the minimum requirements for meeting the first paragraph of 35 U.S.C. §112, as noted in *Feldman v. Aunstrup,* 517 F.2d 1351, 186 U.S.P.Q. 108 (CCPA 1975), but do now represent procedures considered sufficient by the PTO.

The important features of the deposition procedure suggested by the PTO as being acceptable include the following:

(a) An applicant, or his assignee or legal representative, seeking protection for a microorganism invention must deposit a sample of the microorganism in a public depository by the *effective* filing date of the U.S. patent application. Accordingly, a foreign applicant, or his assignee or legal representative, must have made the deposit as of the filing date of the previously filed foreign application in order to obtain the right of priority under 35 U.S.C. §119 based on the foreign filing date[13], since under 35 U.S.C. §119 the effective U.S.filing date of a convention filed application is the foreign priority date.

(b) Restrictions on access to the deposited sample must be irrevocably removed by the applicant and his assignee or legal representative, upon granting of the U.S. patent. The removal of restrictions can be explicitly incorporated into the contract between the applicant, or his assignee or legal representative, and the culture depository. Thus, the contract between the applicant and the depository could state that the culture is being deposited on a permanent basis in connection with the filing of the U.S. patent application, and would require adherence to the PTO regulations[14] pertaining to the secrecy of pending applications, which secrecy would give way to free access to the public upon the granting of a U.S. patent on his application.

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[13] Some case law would indicate that the culture deposit may be made at any time prior to the issuance of the U.S. patent. See, e.g., *In re Fouche,* 439 F.2d 1237, 169 U.S.P.Q. 429 (CCPA 1971), *Feldman v. Aunstrup,* 517 F.2d 1351, 186 U.S.P.Q. 108 (CCPA 1975), and *In re Argoudelis,* 434 F.2d 1390, 168 U.S.P.Q. 99 (CCPA 1970), (Baldwin J., concurring). However, there is no authority directly in support of such a practice, so deposition *before* filing of a foreign priority application is recommended whenever possible.

[14] 37 C.F.R. §1.4 provides that, except for reissue applications and applications for which secrecy has been waived by the applicant:

(c) The name and address of the depository, if such is not well known, and the accession number identifying the applicant's culture in the depository should appear in the application as filed, along with as complete a taxonomic description of the microorganism as is possible.

(d) In addition, the application should be accompanied by an oath or declaration in which the applicant, or his assignee or legal representative, avers to having assured unlimited and permanent public availability of the deposited culture, subject to the granting of a patent on the application, during the 17 year life of the U.S. patent. A copy of the contract with the depository does not need to be submitted with the U.S. application, although the PTO may require a copy as evidence during prosecution of the application. A Statement of Availability complying with this requirement which can be executed by the applicant, or his assignee or legal representative, appears at page 136, *infra*.

(e) Finally, it is good practice to file an oath or declaration of deposit of the microorganism together with the inventor's oath or declaration required under 35 U.S.C. §115, thereby ensuring that the necessary formalities of filing a microorganism patent application have been observed. Someone other than the applicant may be the appropriate party to make such an oath or declaration concerning the deposit, since the applicant's assignee or legal representative may actually be the party to the contract with the depository. Thus, whoever assumes the responsibility to ensure that the deposition requirements of viability and permanence are met may execute the oath or declaration.

Prior to the CCPA's decision in *Feldman, supra.*, it was not clear whether deposition in a private depository or a depository located outside the United States was acceptable to the PTO. However, in *Feldman,* the senior party to an interference concerning claims to a microorganism-based process for producing a particular enzyme had deposited a sample of the microorganism at the Centraalbureau voor Schimmelcultures (CBS) depository in Baarn, Netherlands, prior to the senior party's foreign priority filing date. The CCPA ultimately rejected the argument of the junior party to the interference that deposition in a private depository not located in the United States

was inadequate to satisfy the requirements of the first paragraph of 35 U.S.C. §112.

Since the *Feldman* decision, the United States, Bulgaria, France, Hungary and Japan have become signatories to the Budapest Treaty on the International Recognition of the Deposit of the Microorganisms for the Purposes of Patent Procedure, which came into force with respect to the above-mentioned countries on August 19, 1980.[15] Under the Treaty, the Commissioner of Patents and Trademarks, representing the United States, is authorized to designate one or more microorganism depositories within U.S territory to serve as international depository authorities. An international depository would be authorized to receive and store deposits, and to dispense samples of such deposits, in accordance with the patent laws of each signatory state and the Treaty provisions.

According to a memorandum issued by the World Intellectual Property Organization,[16] an international depository authority must continue to meet certain requirements to achieve and maintain its status as a reception, storage and dispensation agency under the Treaty. For example, an international depository authority must be able to store deposited microorganisms in a viable condition for at least 30 years or until 5 years have elapsed from the last request for a microorganism sample, whichever is later, in such a way that risks of contamination and loss are minimized, and must comply with the standards of reception, viability testing and secrecy imposed by the Treaty. The legal status of an institution applying for depository status under the Treaty is irrelevant, in that it may be either public or private, so long as the prerequisites of the Treaty are satisfied.

The U.S. Commissioner of Patents and Trademarks is currently accepting requests from private and public depositories located in the United States to serve as international depository authorities. In the meantime, any depository, public or private, with which a U.S. patent applicant, or his assignee or legal representative, can contract to maintain a viable microorganism culture generally for at least the effective lifetime of any patent on the microorganism, and to dispense samples

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> ... pending patent applications are preserved in secrecy. No information will be given by the Office respecting the filing by any particular person of an application for patent, the pendency of any particular case before it, or the subject matter of any particular application ... unless the application has been identified by serial number in a published patent document ....

[15] A copy of the Budapest Treaty is published in 961 O.G. 21-26 (August 23, 1977).

[16] A copy is published in 40 Fed. Reg. 61,009 (1980).

of the microorganism on request to the public after the granting of the patent, is likely to satisfy PTO standards for a depository. Foreign deposition with depositories like CBS in the Netherlands and FERM in Japan, are acceptable under U.S. law. However, it is preferred, where convenient, for the deposition to be in a depository in the United States. The U.S. Department of Agriculture depository (NRRL) in Peoria, Illinois, and the American Type Culture Collection (ATCC) in Rockville, Maryland, are two U.S. depositories which the PTO routinely recognizes as suitable for microorganism deposits by U.S. patent applicants. One advantage to depositing with the latter mentioned U.S. depository is that no maintenance fee is required for the 17 year life of a U.S. patent after the U.S. patent issues with notification that the U.S. patent has issued.

III. FORMATS FOR CLAIMS INVOLVING MICROORGANISM INVENTIONS

A. Claims to the Novel Microorganism Per Se

1. "Microorganism per se" Claims (Chakrabarty)

As noted above, even prior to *Chakrabarty* it was possible to obtain U.S. patent claims which, although technically covering the combination of a microorganism with some other material such as a carrier or medium as an article of manufacture or composition of matter, provided a modicum of protection for the microorganism itself. However, in the *Chakrabarty* decision, the U.S. Supreme Court held the following claim language employed by Chakrabarty, which directly covers a microorganism *per se,* to be statutory:

> A bacterium from the genus Pseudomonas containing therein at least two stable energy-generating plasmids, each of said plasmids providing a separate hydrocarbon degradative pathway.[17]

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[17] Many species of bacteria possess genetic elements which exist independently from the chromosomes within the bacterial cell. Such a separate element, or plasmid, usually takes the form of a closed loop of deoxyribonucleic acid (DNA) capable of directing the synthesis of complex molecules which can in turn determine specific attributes of the cell, such as resistances to antibiotic drugs. Certain plasmids are transferrable from one bacterial cell to another, while others are not. The invention in *Chakrabarty* consists of a cell into which as many as four plasmids have been inserted, each capable of providing a different series of chemicals necessary to digest various components of a crude oil mixture. The prior attempts to stabilize more than one transferred plasmid within a cell had failed. But Dr. Chakrabarty solved this problem by fusing two or more plasmids together with DNA-cleaving radiation, thereby rendering them stable within a single cell. The *Chakrabarty* bacterium contained "recombined" DNA from several different plasmids, two of which Dr. Chakrabarty himself had discovered. The bacterium could attack an oil spill efficiently and alone, unlike any bacterial strain in nature.

Claims to novel genetically engineered microorganisms using the *Chakrabarty* format set forth above thus should not be subject to a rejection under 35 U.S.C. §101.[18] The claims considered by the Supreme Court in *Chakrabarty,* all similar to the above, were directed to a bacterial cell as such. From the interpretation lent 35 U.S.C. §101 in *Chakrabarty,* one might reasonably predict that claims to microorganisms would no longer be rejected by the PTO as encompassing non-statutory subject matter under 35 U.S.C. §101.

However, it must be remembered that the invention in *Chakrabarty* was a genetically-engineered bacterial cell, i.e., a living cell whose deoxyribonucleic acid (DNA) content had been altered radically by the direct intervention of man. Although a strong argument can be made that living organisms which are the product of genetic engineering are not different at least from a patentability standpoint from novel "man-made" microorganisms developed by more conventional means (e.g., mutant strains produced by UV irradiation or treatment with chemical mutagens), at least one examining group responsible for handling microorganism applications in the PTO now appears to be routinely rejecting claims to newly developed mutant strains not produced by genetic-engineering techniques. Such rejections appear to be premised on two grounds:

(1) under 35 U.S.C. §101, as a product of nature since the mutant strain can occur as a result of natural mutational processes and may exist in nature;

(2) under 35 U.S.C. §102 or 35 U.S.C. §103 as being anticipated or obvious, over the mutant's parent strain.

For an applicant prosecuting claims to a microorganism which does not contain DNA modified by genetic-engineering techniques, the rejection (1) under 35 U.S.C. §101 above presents a serious problem. Although the examining group in question appears willing to accept proof by the applicant that a claimed mutant strain does not in fact exist in nature, this burden of proof is virtually impossible to sustain in practice. Consequently, until the PTO practice of rejecting mutant strains under U.S.C. §101 is reversed by the U.S. Patent and Trademark Office Board of Appeals, the CCPA or the Supreme Court, an applicant may have to choose between appealing such a rejection or abandoning the microorganism claim in favor of one or more of the alternative formats discussed below.

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[18] See Commissioner's Notice, 997 O.G. 24 (August 26, 1980).

As to the rejection (2) above under 35 U.S.C. §102/103, a showing of both novelty and non-obviousness for a novel microorganism is no more than that required for the patenting of any invention in the United States. Generally, a valid rejection under one of the provisions of 35 U.S.C. §102 requires an explicit description in the prior art of the claimed invention or at least a disclosure which one skilled in the art as it stood at the time of filing would understand to anticipate the invention.[19] Consequently, a strong argument may be made against the propriety of a 35 U.S.C. §102 rejection of a novel mutant microorganism over the parent strain of the mutant microorganism, since the mutant strain by definition differs in some substantial respect from its parent strain. Thus, unless one skilled in the art would anticipate the existence of a mutant strain including its characteristics, given knowledge of the parent strain, a rejection under 35 U.S.C. §102 of a mutant strain over the mutant's parent strain is not proper.

However, a valid rejection under 35 U.S.C. §103 of a mutant strain over a parent strain may exist if the degree of difference in the characteristics of the mutant strain from those of its parent strain is small or the mutant strain characteristics would be obvious from the parent strain characteristics. A rejection of the mutant strain under 35 U.S.C. §103 over the parent strain might require a showing of unexpected properties for the mutant strain relative to its parent strain, or a demonstration of a surprising improvement in a process utilizing the mutant strain in place of the parent strain. In this respect, microorganism inventions would not be treated any differently from obviousness considerations of any other type of invention considered by the PTO.

2. "Biologically Pure Culture" Microorganism Claims (Bergy)

The claim form rejected by the PTO in *Bergy, supra,* was as follows:

> A biologically pure culture of the microorganism *Streptomyces vellosus,* having the identifying characteristics of NRRL8037, said culture being capable of producing the antibiotic lincomycin in a recoverable quantity upon fermentation in an aqueous nutrient medium containing assimilable sources of carbon, nitrogen and inorganic substances.

During the appeal procedures in *Bergy* associated with this claim, two major grounds for rejection were considered:

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[19] Even though an explicit disclosure of the invention does not exist in a single reference, a secondary reference may be considered in conjunction with a primary reference and give rise to a 35 U.S.C. §102 rejection, where the secondary reference represents *evidence* of the background one skilled in the art would apply in analyzing the teachings of the primary reference. See *In re Samour,* 571 F.2d 559, 197 U.S.P.Q. 1 (CCPA 1978). Otherwise only a rejection on the basis of obviousness under 35 U.S.C. §103 would arise for such a combination of references.

(A) the claim covers a product composed of living matter, which does not fall within any of the categories of patentable subject matter described in 35 U.S.C. §101.

(B) the product claimed is a "product of nature", and is therefore unpatentable under 35 U.S.C. §101.

Although the CCPA held the *Bergy* claim was patentable, the *Bergy* claim was not considered by the Supreme Court. Considering the Supreme Court decision in *Chakrabarty* and applying it to the *Bergy* claim format, the "living matter" rejection (A) under 35 U.S.C. §101 is precluded under the Supreme Court's holding in *Chakrabarty* that the classification of an article of manufacture or composition of matter as either living or non-living is irrelevant to whether the subject matter is patentable subject matter under 35 U.S.C. §101. Unfortunately, the disposition of the "product of nature" rejection (B) during the appeals of the *Bergy* claim was not so clear-cut.[20] The "product of nature" ground for rejection under 35 U.S.C. §101 was never heard by the U.S. Supreme Court since such a ground of rejection was not an issue in *Chakrabarty* considered by the Supreme Court, and was considered by the CCPA only incidentally.

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[20] The product-of-nature rejection was issued by the Examiner who first handled the application of Bergy et al, the Examiner citing the dictum in the *Mancy* case as supporting authority. The Board of Appeals affirmed the rejection, but on new grounds that the disputed claim was directed to non-statutory subject matter under 35 U.S.C. §101 because the claim was for "a living organism"; thus, the product-of-nature basis for the rejection was disregarded by the Board of Appeals. Nevertheless, the issue arose again on appeal in the majority opinion of the CCPA, which stated that:

> ... We consider the product-of-nature issue to have been abandoned and no longer in the case. However, since the Solicitor [for the PTO] indicated at oral argument that he was not sure the Board had removed it entirely, we state that we find it wholly lacking in merit. The biologically pure culture of claim 5 clearly does not exist in, is not found in, and is not a product of, "nature". It is man-made and can be produced only under carefully controlled laboratory conditions. 195 U.S.P.Q. at 348.

The majority opinion thereafter rejected the Board of Appeals' basis for rejecting the claim, i.e., that "living matter" fell outside of 35 U.S.C. §101. Unfortunately, the CCPA's first *Bergy* decision was reversed and remanded for reconsideration (but without a clear indication of the Supreme Court's basis for remand) in view of the then recently decided Supreme Court decision in *Parker v. Flook,* 437 U.S. 584, 198 U.S.P.Q. 193 (1978), where the patentability of computer oriented process claims had been considered. On remand, the CCPA reaffirmed its previous decision, but only cited the ground that the living/non-living distinction drawn by the Board of Appeals was without legal significance. Thus, the product-of-nature issue ultimately was left unresolved.

Although the "product of nature" rejection under 35 U.S.C. §101 has only been incidentally considered upon appellate review, the PTO has enunciated a policy of accepting claims cast in the *Bergy* format as overcoming the product-of-nature question.[21] The PTO rationale appears to be that such a claim is directed to a culture as an article of manufacture rather than the microorganism per se and, more importantly, by definition "biologically pure" cultures do not exist in nature and are man-made.[22] Nevertheless, a claim with this format could be susceptible to challenge in subsequent *inter partes* proceedings on the argument that the claim covers an unpatentable product of nature.

Although the *Bergy*-type claim may be considered allowable by the PTO, the "biologically pure" culture language in a claim with this format has no legally tested, well-understood meaning. For example, whether a claim to a biologically pure culture of microorganism X would be infringed by a culture of microorganism X, affirmatively or incidentally, contaminated with the low-level presence of another microorganism strain Y has not been considered by a court in the U.S. In this author's opinion, if the PTO allows a claim to a microorganism on the basis of the presence of the recitation "biologically pure", it is believed serious file wrapper estoppel arises against a court holding infringement of such a claim by any microorganism culture which is not biologically pure, i.e., is contaminated by or even affirmatively mixed with another microorganism.

However, PTO "policy" notwithstanding, there is no statutory requirement that a *Bergy*-type claim to a microorganism or culture thereof include the limitation "biologically pure." An alternative suggested claim format[23], using the subject matter of *Mancy, supra,* that eliminates this phrase is illustrated by the following claim:

> A culture containing the microorganism *Streptomyces bifurcus,* strain BS23219 (NRRL3539), said culture being capable of producing the drug daunorubicin in a recoverable quantity upon fermentation in an aqueous nutrient medium containing assimilable sources of carbon, nitrogen and inorganic substances.

Such a claim is directed to the microorganism culture as an article of manufacture with the wording "capable of" intended as limiting the

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[21] *Supra,* note 18.

[22] In fact, the microorganism in *Bergy* was admitted to occur in nature. However, in the *Bergy* application, the microorganism was claimed as a biologically pure culture of the organism, not found in nature. The impure form as found in nature was incapable of producing lincomycin in at least recoverable quantities.

[23] See Wegner, H.C., 5 *Inter'l. Rev. Industrial Property Copyright Law,* 285 (1974).

scope of the claim's coverage to a microorganism culture sufficiently pure to produce the desired end product upon fermentation. On the other hand, since the "capable of" recitation is functional in nature and is considered to describe the characteristics of the organism rather than its use, it is not considered to limit the claim to the particular use mentioned therein. This claim format would appear to satisfy the requirements of the second paragraph of 35 U.S.C. §112 in particularly pointing out and distinctly claiming the subject matter of the invention, without incorporating the "biological pure culture" language of unknown legal significance.

Even though this claim format would appear to avoid problems in obtaining allowance of claims purportedly covering a microorganism per se before the PTO, it is not considered to provide full protection on a novel microorganism since a microorganism is often separated from its culture medium and commercially marketed in freeze dried form; the freeze dried form is not considered to be a microorganism culture.

B. Claims to Processes Utilizing a Microorganism

When the invention lies in the utilization of a microorganism, known or novel, in a process to produce a novel product or to achieve an unexpected result, the process can be claimed in the U.S. just as any other process invention. Generally, a recitation of the steps involved in the process including any process parameters considered essential in the process would be recited in such a process claim.

1. Microorganism process produces novel product

In the utilization of a microorganism in a process to produce a novel product, generally a claim to such would include the steps of culturing the microorganism on an appropriate substrate and in the presence of any necessary additional materials such as growth factors, trace minerals, etc., as required for the metabolism of the microorganism and could additionally include, as appropriate, the steps of accumulating or concentrating the product produced, recovering the product and separating the product.

A sample claim format for a microbiological process involving the production of a novel chemical material could be as follows:

> A process for producing an antibiotic substance comprising culturing a microorganism of the strain *Microorganismus novela* (ATCC 12345) in the presence of an assimilable source of carbon, and recovering the antibiotic substance obtained.

2. Microorganism process achieves an unexpected result

Microorganism strains can be used to biologically remove pollutants

from the environment. For example, use of microorganisms in domestic and industrial sewage treatment is well known. With the world wide environmental concerns which exist today, interest in utilization of microorganism strains which more effectively treat polluted water and soil or which are designed to remove specific, previously non-biodegradable, pollutants is greatly increasing. The development of mutant strains capable of utilizing a particular pollutant as a metabolyte, where the parent strain from which the mutant was derived is incapable of using the pollutant, is considered exemplary of such an unexpected result.

A claim format for a microbiological process, for example, using a microorganism to remove environmental pollutants could read as follows:

> A process for decolorizing waste water comprising culturing a microorganism of the strain *Pollutus remova* (ATCC 12345) in said waste water, said microorganism utilizing color bodies in said waste water as an assimilable source of carbon.

The above claim formats are merely exemplary of the claim structure which could be used. Of course, the recitations which would appear in the claims of interest to an invention would be specific to the nature of the process involved.

C. Claims To Process Utilizing Microorganism to Produce Known Product

At one time, it was not uncommon for a U.S. patent examiner to reject claims directed to a process utilizing a particular microorganism strain to produce a known product over prior art disclosing either a different strain of the same species of microorganism or a different species of the same genus of microorganism. A U.S. patent applicant seeking to protect an invention arising from his dual discovery of a novel microorganism strain that is useful for the preparation, upon culturing, of a known product tended to find his process claims utilizing such microorganism rejected as merely embodying a choice of a different microorganism strain which is prima facie obvious over such prior art.[24]

However, this type of per se prima facie obviousness rejection was held improper by the CCPA in *In re Mancy,* 182 U.S.P.Q. 303 (CCPA 1974). The CCPA in *Mancy* explicitly overruled *Arzberger* and held that the applicants' claimed process of producing a known antibiotic

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[24] See *Ex parte Arzberger,* 155 U.S.P.Q. 286 (Pat. Bd. App. 1966); cf. *Ex parte Kropp,* 143 U.S.P.Q. 148 (Pat. Bd. App. 1959).

using a new strain of microorganism was not rendered prima facie obvious under 35 U.S.C. §103 by prior art references showing the production of the same antibiotic by different species of the same genus (*Streptomyces*) using similar aerobic cultivation techniques. Therefore, on the basis of *Mancy,* the discoverer of a new microorganism producing a known product should be able to prosecute process claims without encountering a per se prima facie obviousness rejection upon 35 U.S.C. §103. Of course, the question of whether such a microorganism process is obvious over the prior art must still be dealt with.

A process utilizing a microorganism to produce a known product using a microorganism strain, known or novel, previously not known to produce such known product could be claimed, using the subject matter of *Mancy,* as follows:

> A process for production of daunoubicin which comprises aerobically cultivating *Streptomyces bifurcus,* strain DS23,219 (NRL3539), or a daunoubicin-producing mutant thereof, using an aqueous nutrient medium containing assimilable sources of carbon, nitrogen and inorganic substances, and separating daunoubicin formed during the culturing.

However, it should be noted that if the product also is not covered by a patent in the U.S., the protection provided by a claim of this format would not bar a third party from selling in the United States the end product of the microorganism-based process when the process covered by this claim is conducted in a foreign country, since 35 U.S.C. §271(a) requires that the actual process must be conducted in the United States for a finding of infringement. Consequently, a process carried out in a foreign country does not infringe a U.S. process claim, even if the product of that process is imported into the United States.[25]

D. Claims to a Novel Product Produced by Process Using Microorganism

1. *Product Claimed in Terms of Structure Or Chemical/Physical Characteristics*

A novel product produced by a process using a microorganism can be claimed in terms of structure or the chemical and/or physical characteristics of the product just as any chemical material, produced

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[25] A remedy in this context may be sought before the United States International Trade Commission (hereafter ITC) pursuant to 19 U.S.C. §1337 (1970). As amended by the Trade Act of 1974 [Pub. Law No. 93-618, Title III, §341(a), 88 Stat 2053], the ITC is empowered to exclude products introduced into the U.S. by "unfair methods of competition and unfair acts in the importation . . .," "when such unfair methods or acts cause harm to an ongoing *domestic* industry. However, to date there is no relevant ITC case law pertaining to excluding microorganism based products from the U.S.

chemically, can be claimed in terms of structure or its chemical and/or physical characteristics. Recitations in a claim to a product produced by a microorganism can range from recitations of chemical structure in terms of a structural formula along with appropriate substituents present, specifically or functionally, to simply recitations of the chemical and/or physical characteristics of such a product. Often where the novel product produced by the microorganism process is a complex material for which present technology is inadequate to completely define and elucidate the nature and structure of the material, such can be claimed in terms of chemical and physical characteristics. For example, in the case of a complex chemical material such as an antibiotic, recitations in the claim of the chemical and physical characteristics, as appropriate to sufficiently describe the material, are acceptable. Appropriate chemical and physical parameters which can be used, as necessary, include elemental analysis values, infrared absorption spectra, ultraviolet absorption spectra and nuclear magnetic resonance absorption spectra (even referred to by way of figures accompanying the application if necessary), molecular weight, molecular formula and melting point data, solubility characteristics, color reaction characteristics, acidity, basicity and neutrality characteristics, physical form and appearance, chromatographic values, and the like. Recitation of such characteristics serves to identify the nature of the material claimed sufficently even though its actual structure may not be known.

2. *Product Claimed in Product-by-Process Format*

Under U.S. patent law, an applicant is free to claim a product in terms of the process for manufacturing the product, even when the product is susceptible to claiming without reference to the process by which it made.[26] Consequently, an applicant seeking to protect a novel product produced in a microorganism process can claim such a product by reference to the microorganism process by which it was produced. Such a claim format may be useful in covering novel complex materials such as antibiotics, enzymes, hormones, amino acids, etc., produced microbially. Such a claim could take the following form:

> An antibiotic material comprising the antibiotic material produced by the microorganism strain *Microorganismus novelus* (ATCC 12345) by fermentation in an aqueous nutrient medium containing assimilable sources of carbon, nitrogen and inorganic substances.

Product-by-process claim format is particularly useful where it is difficult to chemically and physically describe the antibiotic material,

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[26] See *Ex parte Hartman*, 186 U.S.P.Q. 366 (Pat. Bd. App. 1974), as representative.

where the antibiotic material may in fact be an antibiotic complex of materials and thereby be a mixture, and where there is a possibility that the product of the microorganism process may be manufactured abroad by a third party using the microorganism, and then imported into the United States. As noted above, claims directed to a method of using the microorganism would not be infringed by a third party conducting the process outside the U.S. and importing into the United States the product manufactured abroad. In contrast, a U.S. patentee with microorganism product-by-process claims would have recourse against importers of the foreign-manufactured microorganism product pursuant to the coverage provided by a microorganism product-by-process claim of the type discussed above.

E. Claims to Process for Microorganism Modification

When an invention lies in a process for producing a "modified" and thereby man-made organism, claims covering such a modification technique would recite the active steps required to achieve the modified microorganism from its "parent". Because the steps involved vary so greatly, it is difficult if not impossible to set forth an appropriate claim format in a generalized form. In view of the difficulty in generalization, perhaps the best way to exemplify formats found acceptable by the PTO is simply to list recently issued U.S. patents containing claims involving microorganism modification techniques, which include Chakrabarty, U.S. Patent 3,923,603 (Claims 1 to 10); Chanock et al, U.S. Patent 3,992,522 (Claim 5); Hung et al, U.S. Patent 4,224,408 (Claims 1 and 2); Thirumalachar et al, U.S. Patent 4,082,613 (Claim 1), and Curtiss, U.S. Patent 4,190,495 (Claim 1) and Cohen et al, U.S. Patent 4,237,224 (Claims 1 to 11 and 14).

IV. SUMMARY AND CONCLUSIONS

The patentability in the United States of various different types of inventions involving microorganisms, including microorganisms per se, has been discussed above. With the Supreme Court decision in *Chakrabarty* holding that man-made microorganisms constitute patentable subject matter and with the technological advances presently being made in microbiological technology, it is expected that activity in the microorganism area will increase even more. The promise of being able to accomplish microbiologically what is either impossible or technically difficult to accomplish chemically or too expensive to consider chemically even further piques the interest of researchers involved in the area of microbiology and particularly the interest of the patent practitioner.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

_____ GROUP: _____

Serial No. _____ EXAMINER: _____

Filed: _____

For: _____

STATEMENT OF AVAILABILITY

Hon. Commissioner of Patents and Trademarks
Washington, D.C. 20231

Sir:

We, _____ a corporation of _____, located at _____, _____ do depose, declare and state that

We are the assignee of the entire right, title and interest of the invention described and claimed in the above-named application as evidenced by an assignment thereof submitted simultaneously herewith for recordation in the United States Patent Office;

We agree that upon allowance and issuance of the above-named application as a United States Patent, all restriction on availability of the culture deposits designated in the specification of the above-named application will be irrevocably removed; and

We agree that the cultures will be maintained throughout the effective life of said patent granted on the above-named application.

Respectfully submitted,

Date: _____ _____

(Corporate Seal)

SOCIAL & TECHNICAL INVENTIONS: CHALLENGES TO LEGAL AND POLITICAL INSTITUTIONS*

HARVEY BROOKS**

President Rines, Ladies and Gentlemen, let me begin by saying how honored I am at being invited to present a lecture named in honor of my friend Francis Davis, who was one of a gradually disappearing breed, the independent inventor. His type is gradually being replaced by the corporate inventor as the "ecology" of innovation becomes more complex and more dependent on the cooperative interaction of different areas of specialized knowledge.[1] Even within the corporate environment, however, the individual "champion" remains the driving force for innovation, but less and less frequently can he operate as a "loner" — an individual self-sufficient in skills and instruments, as Francis Davis was.

Tonight I would like to talk about what I see as an emerging trend in innovation, the increasingly close interaction between social and technical innovation. More than has been generally recognized in fact by popular accounts of technological innovation in the past, most innovation has had a social dimension, but I believe this aspect is becoming relatively more important.

As we move into the 1980's, two public concerns relating to technology seem paramount throughout the industrial world. These concerns are partly complementary and partly conflicting. Indeed, sorting out the conflicts and synergisms is one of the functions of social innovation in the overall innovation process. In talking about innova-

*The Francis Wright Davis Distinguished Lecture, November 22, 1980.

**Benjamin Peirce Professor Technology and Public Policy, Harvard University; Overseer of Franklin Pierce Law center.

[1] Melvin Kranzberg and Patrick Kelly, ed., *Technological Innovation: A Critical Review of Current Knowledge,* Vol. I. The Ecology of Innovation, prepared for the National Science Foundation, February 1975, PB-242 550, dist. by National Technical Information Service, Dept. of Commerce.

tion I trust I do not need to remind this audience that innovation is not the same as research and development. Rather it is the name for the whole process extending from the research laboratory to the final commericalization of a product or process. Research and development usually constitute a small fraction of the total cost of innovation — often less than ten per cent.

Within the last two years a very broad consensus has emerged in this country on the importance of technological innovation for the future both of our own economy and that of the world as a whole. There is a wide perception of a slow-down in technological progress and a belief that technical progress is the key to overcoming declining productivity, stagflation, and unemployment in the industrialized world. That is the first trend.

At the same time there is a growing sense of unease about the unintended side-effects of technological development, a feeling that technology is somehow out of control and ought to come under stronger social direction. Thus at the same time we are calling for more technology to pull us out of the economic crisis and energy scarcity, we also are calling for more assessment and regulation of the consequences of technological development, with the burden of proof shifting dramatically against the proponents of specific new technologies.

It could be argued that the accelerators and the brakes with respect to technology are operated by different people and that we are in a sort of stalemate resulting from the simultaneous application of these two levers. Though there is some truth in this, it is an oversimplification in my opinion. There is a good deal of overlap between the two groups; only at the extremes do we find people willing either to forego technological progress and economic growth or willing to move full speed ahead regardless of consequences to health, safety, or ecology. There is a widespread consensus on both growth and environmental goals; the differences arise mostly in the details of implementation and on the exact point of trade-off when they are in conflict.

Also, the goals are complementary in some respects. For example, there seems to be general agreement that economic growth provides the surplus necessary to increase investments in "collective goods" such as environmental quality, or to improve distributional equity. Conversely, the side-effects of unregulated technological deployments may actually inhibit future growth through the destruction or degradation of resources that could otherwise be exploited economically, for example clean fresh water. There is also considerable empirical evidence that in the words of Aaron Waldovsky, "richer is safer", that

there is a correlation between personal health and safety and average per capita income over time, between different income groups within countries, and between countries.[2] We often do not understand the causal connection between "richer" and "safer"; and in this respect it is a little like smoking and cancer, but the correlation is certainly there. This is paradoxical because, despite abundant contrary evidence, the average person believes life to be more hazardous today than it was a generation ago. One can speculate on the causes of this. One factor is certainly the fact that new hazards and disamentities are news, while the elimination or reduction of old hazards is not news. Another factor is certainly the existence of a few speculative but very scary hypothetical hazards associated with new technologies, perhaps most notably the threat of nuclear war; less notably, but important, the possibility of nuclear reactor meltdowns. Such events have the potential to reverse the long term trend towards a less hazardous existence. Still another factor, perhaps, is the possible existence of low level health threats such as new carcinogens dispersed in the environment. These may have a very long latency period, such that we could be storing a time bomb for some future time when a rash of previously unappreciated consequences of current activities could appear on the scene. Enough examples of this phenomenon have developed in localized situations — e.g., the case of asbestos workers or the Love Canal type incidents — to make this a not totally implausible fear. Although these examples are much too isolated to influence gross mortality or health statistics, they do contribute to the public perception of increased hazard. The public perception exists despite increasing average life expectancy and decreases in the age-specific incidence of most of the very malignant diseases that contribute to the belief in increased hazard.

Also the fact is that on average "richer is safer" does not prove we could not be a lot safer than we are. Perhaps we could be a whole lot safer than we are by being only a tiny bit poorer. Despite an enormous amount of debate there is very little solid data on the true economic cost of health, safety, and environmental improvement. Although the cost has been high and accelerating in recent years, much of this may be due simply to the catch-up for past mistakes. There is certainly considerable evidence to support a belief that the cost of health, safety, and environmental protection for new facilities is far lower than the cost of equal safeguards retrofitted on old systems.

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[2] Aaron Wildavsky, "Richer is Safer," *The Public Interest* No. 60, Summer 1980, pp. 23-39.

This suggests that once we have caught up, future costs relative to GNP (gross national product) may decline, or at least stabilize. It also suggests the desirability of anticipating a tightening of future standards when making new investments, especially those, such as power plants, that are likely to have a very long economic life.

Let me now come back to the social dimensions of innovation. One can, perhaps, distinguish three broad categories of innovation according to the importance of the social, institutional, or managerial component.

The first type is the most purely technical. Generally this type of innovation is derived mainly from a scientific discovery. Two recent examples are the transistor and the laser. Many important modern technological innovations have also depended on advances in materials, either to develop new properties, or to develop new and cheaper ways of forming or processing materials. Such materials innovations also appear to be mainly technical. However, in all these examples an initial technical innovation tends to generate a need for ancillary technologies and also for further changes and improvements in manufacturing systems. Eventually the complex of interrelated innovations derived from the originally purely technical advance may have profound social consequences, and require major social and managerial adjustments. The transistor, for example, led through a sequence of related and collateral innovations to integrated circuits, which in turn drove the so-called information revolution, the societal aspects of which are self-evident. Thus the realization of all the innovations derived from the transistor has already required, and will continue to require in the future, a host of social and managerial innovations: computerized newspaper publishing, electronics funds transfer, the computerized office, eventually the substitution of electronic signals and storage for ink-on-paper throughout our society.[3]

The second type of innovation may be described as sociotechnical. It is systems innovation based on a complex of interrelated technologies and organizational innovations, sometime but not always derived from a single physical artifact. These social and technological innovations are completely interdependent — one cannot occur without the other. A classic example is the sociotechnical system surrounding the automobile. This includes: automobile manufacturing technology, the system of highways and road construction technology, the system of dealers, gasoline stations, and repair shops for automobiles, the au-

[3] Anthony Smith, *Goodbye Gutenberg – The Newspaper Revolution of the 1980's*, Oxford University Press, New York and Oxford, 1980.

tomobile insurance system, the whole adjudicatory and legal system of which automobile-related litigation and law enforcement constitutes such a major fraction,[4] the international oil supply and delivery network, and so on almost ad infinitum, all associated and built around the original artifact — the automobile. Although one can think of the automobile and its immediately related technologies as constituting a distinct and self-conscious locus of innovation (after all, the auto companies are among the largest industrial R&D spenders in the United States), most of the system grew by accretion with little systematic innovative activity.

Another major example of sociotechnical innovation is the revolution which has occurred in both the technology and organization of the modern metropolitan newspaper. This has been graphically described in a recent book by Anthony Smith, *Goodbye Gutenberg.*[5] The public consciousness of this revolution has come largely through the struggles between the publishers and the printing unions, as exemplified in the cases of the New York Times and the Washington Post.[6] But that is only the tip of the iceberg. In fact, this sociotechnical revolution has probably been the only thing that saved the great newspapers from economic extinction as a consequence of competition from the electronic media, particularly broadcast television. The newspaper revolution was a quite self-conscious one, spark-plugged by an industry association which was technologically aggressive and forward-looking and driven by the hot breath of threatened disaster from competition. There were two main aspects of this revolution: the segmentation of markets and the development of techniques necessary to accommodate to it, on the one hand, and the computerization of the whole reporting-editing-typesetting-printing process on the other. For market segmentation, the technique was "zoning", the tailoring of newspapers to small groups of readers by means of technology and organization to sort out specific reader interests and locations, with automatic labeling and automatic selection and insertion of package inserts designed for a specific readership. This was the distribution side of the system which enabled the metropolitan newspapers to maintain their markets in the dispersed suburbs against the competition of the suburban papers. On the production side, the

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[4] Daniel P. Moynihan, ch., *Report of the Secretary's Advisory Committee on Traffic Safety,* U.S. Dept. of Health, Education and Welfare, Feb. 29, 1968. Cf. esp. pp. 94-103.

[5] *Goodbye Gutenberg, supra,* p. 292.

[6] *Id.,* p. 213, 231.

revolution was more profound. In the words of Smith,[7] "In the transference to computerized methods, many of the principal pioneering newspapers have had to undertake detailed descriptions of themselves as communication and social systems while preparing the specifications for the physical machinery they are ordering." In other words, the newspaper publishing revolution was a sociotechnical revolution — in which the organization and the technology were intimately bound together.

As I will explain in a moment, this sort of sociotechnical innovation will be increasingly important in dealing with some of the environmental and energy problems which we face in the coming decades; the challenges are not unlike those faced by the newspaper industry in the 1970's, and require a similarly innovative response.

The third category of innovation is almost purely social, managerial, or institutional, at least in first appearance. Historical examples include the withholding tax, the supermarket, the MacDonald's restaurant system, no-fault auto insurance, the environmental impact statement, health maintenance organizations. Other social inventions under active discussion that have not taken hold as yet include the negative income tax, housing and school voucher schemes, new utility rate structures, and so on. These innovations appear to be purely social or managerial, but they often generate demands for the purely technological innovation as an ancillary part of the process. The withholding tax, for example, would have been impractical to administer without the computerization of the IRS. The supermarket and MacDonald's have given rise to a whole set of incremental technical innovations — too small in one sense to get much notice — aimed at increasing the efficiency of the managerial system which is at the heart of the innovation. The requirement for environmental impact statements has given rise to technologies for gathering baseline data on environmental systems, as well as to the development of computer models of the systems.

Of course one of the great managerial innovations of the 20th century has been the institutionalization of the process of technological innovation itself in large industrial or government laboratories. There has been no corresponding institutionalization of the process of social and managerial innovation, although the rudiments of it have appeared here and there. The New York RAND Institute,[8] which advised the City of New York regarding managerial innovations to im-

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[7] *Id.*, p. 189.

[8] The New York Rand Institute, *Final Report* 1969-1976.

prove efficiency of city services under the Lindsay administration, is an example of one such attempt, one that foundered in politics. The non-profit organization Public Technology, Inc., created by the National Science Foundation about 5 years ago, for the purpose of aggregating innovation requirements of cities is another example.[9] But for the most part, social and managerial innovation is still in the hands of the individual inventor or policy entrepreneur or it occurs as part of the normal learning process in organizations, much like the incremental improvements in manufacturing which occur along the "learning curve" after the introduction of a new product or process in manufacturing. It is my view that one of the unfinished tasks of the 1980's will be the institutionalization of social and managerial innovation, both in the public and in the private sectors. In fact, I have discovered in discussing the question of social innovation with many people in the private sector that they seem to automatically equate social innovation in their minds with the "great society" of the 1960's; I by no means have such a restricted view of social and managerial innovation in mind. Most such innovation in fact I believe will take place in the private sector rather than the public sector.

The social sciences have made considerable progress in modeling what happens in various kinds of organizations and social situations, but they have not developed a process which is analogous to "development" in the physical or biological sciences. Perhaps the nearest to it is the use of simulations in the training of aircraft crews, astronauts, and business decision makers. Such large scale tests as the negative income tax experiment or the housing voucher experiment are also forms of development in the social sphere but it has proved difficult in these cases to insure that the information gathering process keeps up with the policy needs. Nevertheless, this appears to be the general direction in which social "development" techniques should be sought. It is also true that as a society we are much less ready to tolerate unsuccessful or even partially successful experiments in the social sphere as compared with the sphere of physical technology. In fact the tendency to reach quick, overall judgments about social experimentation in its early phases may be one of the biggest inhibitions to social "development". This is understandable of course be-

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[9] *Urban Consortium for Technology Initiatives 1981 Annual Report.* Prepared for the National Science Foundation, Division of Intergovernmental Science and Public Technology, by Public Technology, Inc. under NSF Grant No. ISP78-12729. Washington, D.C. Public Technology, 1981; Ford Foundation, The Local Initiatives Support Corporation: A Private-Public Venture for Community and Neighborhood Revitalization, May 1980.

cause people are involved, but also regrettable in the longer term perspective. At the same time we are often ready to introduce innovations on a large scale without any prior experimentation.

Now I would like to turn to some examples of the needs for social innovation in the future. One of the interesting aspects of modern information technology is the separation between hardware and software. The same physical technology can be used in conjunction with many different programs and data bases. It is the software which relates most closely to the human parts of the system. This offers the opportunity to program the technology to meet the needs of human beings, for example in computerized offices, rather than forcing human beings into the mold set by relatively inflexible technology which was the characteristic of the early part of the 20th century when technology was based primarily on mechanics. The same applies to an increasing degree in manufacturing settings as well as offices and financial institutions. Wickham Skinner, a professor at the Harvard Business School, has written of the tradition that "technology has been an irresistible prime mover that inevitably defines working tasks and working environments" and of the underlying assumption of work organization that the people problems presented by otherwise profitable and "efficient" technology can be overcome by organization and discipline without changing the technology.[10] This is in fact the philosophy underlying the system of "scientific management" developed by Frederick Taylor[11] and others in the early part of the twentieth century. It is a system which worked very well with a relatively uneducated and "docile" labor force, but has become increasingly obsolete and counterproductive in the last two decades. Swedish industry, particularly the automobile industry, has pioneered in experiments to adapt technology to the work force rather than vice versa, notably in the Volvo factories where the traditional assembly line has been virtually eliminated.[12] General Motors in this country is now moving in similar directions, as are the American Telephone and Telegraph system and other large technology-intensive organizations.

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[10] Wickham Skinner, "The Impact of Changing Technology on the Working Environment," in C. Kerr, J. M. Rosow, eds., *Work in America: The Decade Ahead,* Van Nostrand Reinhold Company, New York, London, etc., 1979, p. 204.

[11] Edward Layton, *The Revolt of the Engineers,* Case Western Reserve University Press, Cleveland, Ohio, 1971, Chapter 6, pp. 134-153.

[12] Swedish Employers' Confederation Technical Department, *Job Reform in Sweden: Conclusions from 500 Shop Floor Projects,* trans. David Jenkins, Grafisk Reproduction, Stockholm, 1975, pp. 125-126 and Chap. 7, "The New Factories."

An illustration of the growing importance of sociotechnical design, as it is called, is provided by the nuclear power industry. John Kemeny has spoken of his surprise in discovering that the breakdown at Three Mile Island was a sociotechnical failure, not a technical failure.[13] The organization and the human-technical interface in a nuclear power plant had failed to take into account the lessons learned painfully over a long period of evolution in the aircraft industry, and later in the Apollo program.[14] It now seems evident that the problems of nuclear reactor safety will require much more innovation in the social and managerial sphere than in hardware, and may eventually extend to the whole management structure and style of the industry.

Even in the case of nuclear waste management, it appears, to me at least, that the problems are much more social and political and managerial than technical. All the technical elements of a satisfactory solution are available and have been demonstrated individually on a small scale. The problem is to develop a set of sociopolitical procedures to actually create repository sites which are acceptable to all the constituencies potentially affected. What is required is a step-by-step process which inspires public confidence at each successive stage until a full system is in place. Such a system is much harder to create today — perhaps even impossible — because in the past the problem was postponed as one that could be safely left to address after nuclear power had proved itself in other respects. From a purely technical point of view this might have been reasonable, but from a sociopolitical standpoint it was disastrous. Now the need for innovative approaches and social mechanisms is much greater than it would have been had the problem been systematically addressed earlier.

The same observations apply but with much greater force in my opinion to the disposal of chemical wastes. From a technical standpoint the safe management of toxic chemicals is a far more difficult and complex problem than the management of nuclear wastes, popular opinions to the contrary. The volume of these wastes is much larger, and their toxic and other characteristics much more variable and heterogeneous. The potential health effects are much less well known than in the case of radioactive wastes. The number of separate sites required is much larger, and, more fundamentally, the economic

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[13] John G. Kemeny, "Saving American Democracy: The Lessons of Three Mile Island," *Technology Review*, June/July 1980.

[14] George M. Low, "Space Program Experience," in *Outlook for Nuclear Power*, pp. 32-38, National Academy of Sciences, Washington, D.C., 1980.

cost of safe disposal is a much more important consideration, since it looms larger in comparison with the economic value of the activity which gave rise to the wastes in the first place. If the potential toxicity of chemical wastes in terms of the gross number of lethal doses produced were estimated in the same way as is often done in popular presentations of the nuclear waste problem, chemical wastes would be regarded by the public as much more scary than nuclear waste. There are many technical, organizational, and political innovations required to deal with future chemical waste disposal and to deal with the accumulated wastes from activities of 25-30 years ago. The problem of wastes is a classic case of conflict between local interests and larger public interests. Everybody enjoys the benefits, but nobody wants to bear the risks, expecting that a way will be found to push them into somebody else's backyard, or into the global commons. Are compensation methods, for example, a politically feasible or morally acceptable way to deal with this problem? This is an area in which clearly a great deal of innovative and imaginative thinking is required, mainly in the social sphere.

The changing environment of energy supply is another domain where social and political innovation are urgent. The initial U.S. response to the 1973 crisis could not have been more counterproductive had it been consciously designed to exacerbate the problem as much as possible in as short a time as possible. Price controls on oil and gas encouraged consumption, and the entitlements system was equivalent to heavy subsidy for the importation of foreign oil. Price controls on interstate natural gas stimulated overconsumption, discouraged supply development, and generated a physical shortage of natural gas for industry which compelled many industrial consumers of gas to switch to imported oil. Virtually all the increases in oil imports that took place between 1974 and 1979 were offsets to declines in natural gas production during the period, most of which were unnecessary.[15]

What this experience shows is that social innovation can have unintended side effects as serious as technological innovation. The entitlements device was certainly a social innovation, and its impact on the U.S. energy problem, which it was designed to alleviate, was seriously counterproductive. In this example the side effects arose because equity and the reduction of immediate economic impact took precedence over reduction of oil imports, even though the announced goal of U.S. policy was "energy independence."

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[15] Joseph Nye and David Deese, eds., *Energy and Security,* Ballinger Publishing Company, Cambridge, MA, 1980.

An example of an area of needed social innovation in the energy field has to do with the regulation of utilities, which I will exemplify with electric utilities. This, by the way is an area in which this institution (Franklin Pierce Law Center) has pioneered and I feel a little bit as though I were carrying coals to Newcastle in using this as an example.

The whole system of utility regulation evolved in an environment of increasing economies of scale, rapid productivity increases due to technical progress, and declining electricity prices. Regulatory lag and the fact that allowed rates of return were based on average historical investment costs rather than replacement costs meant in practice that prices received for electricity exceeded the marginal or replacement costs of the power produced. Now, in a period of inflation (and hence rising replacement costs for capital) and of rising fuel prices, we have exactly the opposite situation, namely, the prices received for electricity are less than replacement costs. Hence regulatory lag and rate of return regulation mean that revenue cannot possibly finance replacement, let alone capacity expansion made necessary by the artificially low prices resulting from the regulatory policy. Thus we suddenly find ourselves in a situation where utilities have strong incentives not to add to capacity, but indeed to induce consumers to save electricity. This may not be bad in itself, but the resulting situation is one in which undercapacity is certain in the future if policies are not changed. The likelihood of this is not visible today simply because we are still enjoying some overcapacity resulting from expansion plans made during the earlier time of declining prices.

Several states have begun to pass innovative legislation to allow utilities to finance energy efficiency investments by consumers and incorporate these investments in their rate base, in other words, to finance conservation rather than new supply. In one, the so-called Oregon law,[16] the utilities advance interest-free loans to consumers, which are included in the rate base and repaid to the utility. They are removed from the rate base only when the house is sold. However, this represents only the beginning and one example of a whole set of innovations that will have to be introduced into the regulatory system in order to accommodate the new environment of rising costs and rising fuel prices. The American Northwest, of course, is unusual in

[16] Arthur H. Rosenfeld, *Some Potentials for Energy and Peak Power Conservation in California,* LBL-5926, October 1977 (Energy and Environment Division, Lawrence Berkeley Laboratory, University of California, Berkeley.

that the actual price paid for electricity by consumers takes into account about ten percent of replacement cost of the capital equipment owing to the fact that the average price of the electricity is mostly determined by the capital costs of hydro-electric investments made during the Great Depression of the 1930's.

Indeed one can say more broadly that removing the obstacles to implementation of conservation technology which would be economically viable if the benefits of energy savings to the consumer reflected the true replacement cost of the energy saved, requires mainly institutional and social innovations, not new technology. The physical technology either exists or would be readily developed and marketed if in fact prices reflected marginal costs and various regulatory and institutional barriers could be overcome.

A similar area for social and institutional innovation will arise in the future and will be created by the introduction of decentralized energy sources into large scale electric grids, mainly supplied by large central station generators. These decentralized energy sources which are often referred to in the trade as "distributed stochastic" sources are likely to be increasingly important in the future, although I am not one that believes that they will completely take over from the traditional sources of electricity. They include such devices as wind generators, solar cells, low head hydro, and so forth, whose outputs are variable and in many cases unpredictable and not necessarily coincident with demand. If such sources are to be integrated beneficially, without causing a deterioration of the economics of existing systems a good deal of social innovation will be needed. The group under Peter Brown at the Franklin Pierce Law Center is, of course, one of the pioneers in this particular area.

Finally in closing I would like to simply mention in general terms another area where it seems to me that the possibilities for social and managerial innovation are very important: the whole subject of environmental regulation. So far in the United States, almost uniquely compared with the rest of the world, we have adopted an adversarial mode of regulation, what Charles Schultze, the Chairman of the Committee of Economic Advisors of the Carter administration, has labelled, the "command and control mode" of regulation.[17] Although Schultze came into the government dedicated to the idea of substituting economic incentives for command and control, the in-

[17] Charles Schultze, *The Public Use of Private Interest,* Brookings Institution, Washington, D.C., 1977; Frederick Anderson et. al., *Environmental Improvement through Economic Incentives,* Johns Hopkins Press, Baltimore, for Resources for the Future, 1977.

ertia of the system was such that relatively little progress has been made in that direction. Although I was not a supporter of Mr. Reagan in the last election, I believe that one of the benefits of the new administration will be, in fact, to open up a great deal of scope for innovative ideas in the area of environmental health and safety regulation by means of economic incentives rather than by command and control.

Thus the major message that I want to leave really is that when one looks at the question of innovation in a broad context the combining of technological, social, and managerial innovations is the direction in which the continued health and innovativeness of the American system must lie.

QUESTION & ANSWER PERIOD

Question: You mention the law of social innovation which breaks down into a lot of categories I assume. One that seems particularly relevant since this is a law school — is legal innovation, innovation in legal ideas. You mentioned that technological innovation has been centralized and is becoming institutionalized and so on. Social innovation much less. It seems from the way you've described it that legal innovation really is almost non-institutionalized; it is in the hands of the individual advocate, a particular judge, or a particular legislative committee. Do you see any possibility or any wisdom or any movement in legal education or in the law for systematizing change in the law itself or would you rather it stay pretty antiquated and out of peoples' way?

Answer: No! Well, first of all the answer to your last question is "no". I certainly would welcome a more systematic base for innovation in the law. I think it's not only a question of legal education but perhaps for the innovative thinking of a more scholarly research oriented sort in the law. But I guess I don't know enough about law and legal institutions really to answer your question other than by throwing it back at you.

Question: When you talk about technical innovation, I think you talk about the scientific method and the way of approaching the expansion of some mechanical or electronic technique by application of the scientific method to controlled experiments. When you talk about social and institutional innovation, I don't have a method that I can think of that would be applicable to that area or a set of disciplines that would yield the same certainty as to the output or the result that the scientific method does. Do you have a method in mind?

Answer: Let me make several comments. First of all, I think you exaggerate the role of the scientific method in technological innovation. It's much more of a cut-and-try process, even though science makes a large contribution to the codification of knowledge on which you can draw to make theoretical predictions regarding the consequences of various technological systems. Nevertheless, I think there is still a great deal of cut-and-try now. One of the big things that has developed in the technological field in the last 20 years is our ability to model rather large and complex technological systems without in fact exercising the complete system experimentally, and that has been a relatively recent development. I can remember talking to one of the astronauts soon after he came back from a flight and asking him what it felt like, and he said, "Well, it was really very boring. I had rehearsed on a simulator so often all the things that could go wrong with the system that by the time I got up in space it was so routine it didn't seem like anything." And I think that's one of the things we've learned to do but relatively recently — with certain technological systems — but the ability to do that has not been equally spread across all technologies. I think you need something like this in the societal area but I think we're just groping really for the correct institutional framework. There was a period in the 1960's when there was a great deal of *hubris* among social scientists as to what they could do and in fact some of the "Great Society" programs were really predicated on this sort of a *hubris* with respect to what the social sciences really knew. I don't think this is a problem that is going to be solved overnight with some magical institutional invention but I think you can see here and there little pieces of inventions which, by being put together gradually over time, may create a system of social innovation which is a little bit more like the system of technological innovation. However, because of the number of variables involved in a social system I think it will never match what you can do with physical systems. But of course there are physical systems and physical systems. It is one thing to design the Voyager system to reach Saturn and be able to get there within a few hundred miles because nothing much is involved except Newton's law of gravitation. But it is quite another thing, let's say, even to talk about the effects of carbon dioxide on the future world's climate because in fact the number of variables involved is so large, and that makes it more like a social system. Thus, even in physical systems we have varying degrees of complexity. Understanding and predicting climatic changes, for example, is a good deal more like understanding and predicting social changes than it is like predicting the trajectory of a space craft or the course of a chemical reaction.

Question: There was a sort of tincture of manipulativeness to your notion of social innovation and I put it that way because we are all manipulated I suppose all of the time by social innovation but at least those of us in the ivory tower don't like to dirty our hands with that sort of thing. Do you have any comment on that?

Answer: Well — I don't know quite in what you saw the tincture of manipulativeness. I guess I would define manipulation as influencing peoples' behavior without telling them you're doing it. I don't think there's anything I said which implied that's what I want to do.

Response: I'm not suggesting that it's what you want to do — but I was suggesting that that was perhaps a necessary implication of what you were calling for.

Answer: No! I don't see that it is. What I was really calling for was manipulating the incentives acting on people, or in other words changing the rules of the economic game so as to make private incentives agree better with desired social objectives.

Response: Well, let's take the example of disposal of nuclear waste. Bob [i.e., Robert H. Rines, President of Franklin Pierce Law Center] and I were talking with Ken Germeshausen [former Chairman of the Board of EG&G Inc. and an Overseer of Franklin Pierce Law Center] recently, and he impressed upon us that it was child's play to dispose of nuclear waste, highly consistent with what you said — that it's social innovation we need, not technical innovation. Now what kind of social innovation will do that?

Answer: I'm not sure I know. I am sure we have a lot of catching up to do because of the way the problem has been mismanaged in the past. I think you have to go step by step in bringing people along with the process so that they see what you're doing, they see what the situation is. Now of course the nuclear waste problem is complicated by the fact that there are a lot of people who prefer to say there is no solution to the problem because they really don't want there to be a solution. Rather they want to use the alleged lack of a technical solution as a club with which to beat nuclear power. I don't think there's any way that that problem can be dealt with directly. One has to deal with what I would call the middle group of the public that is genuinely on the fence with respect to these issues, but that has been brought to distrust the system because of the way one problem has been handled in the past.

Question: This is a corollary to the previous question. I have heard that you can re-process into re-usable fuel 85% of the nuclear waste;

that through better technique you can lock up the rest of such waste. Would you confirm if that is correct and, if it is correct, does it then not become a sociological problem of defending it?

Answer: Well, I think what you say is essentially correct except that I would add one point: you cannot talk about the problem of nuclear waste finally when you're talking about the actual, practical disposal except in site-specific terms. In other words, one of the difficulties with the nuclear waste problem has been that people have been saying all along the problem is soluble in principle; but in order to make sure you have a solution, you have to have a great deal of data, geological data, and other kinds of data in regard to the specific site that you have chosen. Right now one of the problems in this country is that people are not even willing to allow you to get the necessary data on the characteristics of possible sites in order to select the safest ones. Thus you have a kind of chicken and egg proposition.

Response: But if you can reclaim a large portion of the fuel and re-use it, you thereby eliminate the disposal problem — I think.

Answer: What you say is only one-half right. The problem is a little more complex than that. The only part that's worth re-claiming at the present time is the plutonium. Now actually you can reclaim more than 99% of the plutonium, not just 85%. That's what the French are getting out now. But the plutonium is a concern only when you're talking about storage for hundreds of thousands of years, and even then you're talking about a concern which is orders of magnitude lower in terms of the amount of radiation involved compared with the radiation of fission products that's in the waste to begin with. But as far as reclaiming the fission products, while this could conceivably ultimately be economically worthwhile, it is not so at the present time. Nevertheless, the fission products can be safely encapsulated in glass, although there are probably better ways of doing it in ceramics, or quasi-crystalline materials, so that its escape or the amount of radioactivity that you get into the environment is orders of magnitude smaller than the natural radioactivity that already exists in the environment and that is the only kind of criterion which you can really use.

Question: People speak of the certainty of physical sciences but not in the social sciences.

Answer: Yes. I think I agree if I understand what you're saying. There's another way of putting it and that is that everybody is an expert in the social sciences. And that means in fact they think it's

intuitive. Everyone has two possible reactions to social science conclusions: either that they're obvious and one didn't have to do all that research to reach such a self-evident conclusion; or in fact they must be wrong because they disagree with his intuitive conclusions. But the other problem is that in even the most supposedly exact of the social sciences there are different schools of thought which disagree very much. It is the disagreements that always tend to be emphasized to the layman. One seldom hears anything about the areas of agreement. But unfortunately the disagreements are the greatest in those areas of the greatest policy relevance and that is part of the problem.

Question: I was thinking with Reagan coming in one of the last grand things of the Ford administration might be resurrected — the Science Court. Do you think it's worth testing?

Answer: No! I'm very skeptical of the Science Court and I've argued and debated with Arthur Kantrowitz, former Chairman of Avco Everett Research Laboratory, Inc.; Everett, Mass. about it for something on the order of 20 years. I think there may be a few cases in which the Science Court might be a good idea. I would say that in the case of flurocarbons and the ozone layer the Science Court might have been a useful way to help resolve the scientific issues. But there are very few cases to my knowledge where a policy decision hinges on the scientific data, or scientific conclusions alone. More often it's a blend of scientific conclusions and values or political preferences. Take the issue we were talking about — nuclear waste disposal or nuclear reactor safety. If you really pin people down in a private unemotional atmosphere about what the facts are in these two areas, there turns out to be suprisingly little disagreement. The big disagreement even between the experts is on how you should interpret those facts and what conclusions you should draw from them. A very big part of this really has to do with where you think the burden of proof should lie. The people who are very worried about nuclear safety and about waste disposal and so on, are asking for a very much higher standard of proof with respect to the impossibility of any kind of adverse effects than are the people who are more relaxed about these issues. That is something that is very, very difficult to sort out. In fact it's very interesting to me that the anthropologists have begun to look at this problem and are coming up with some rather interesting insights on the relationship between attitudes toward risks and social character, but it's still very unclear to me what you can do with this information.

Question: Should there be a cost/benefit factor?

Answer: My view is that cost/benefit analysis is a very useful tool for decision making, but it becomes totally counter-productive if it is used as a sole criterion for decision making. The reason is that cost/benefit analysis involves the aggregation of risks, almost invariably, or the aggregation of benefits, different elements of which different people in society have different judgments about.

Let's take the case of the radioactive threat from nuclear energy. You have routine emissions from nuclear reactors; you have the possibility of catastrophic accidents. You can calculate within quite reasonable limits, the expectation value of fatalities per year from nuclear reactors by aggregating the risk due to routine emissions, to uranium mining, and to reactor accidents. But that is only expectation values. There are many people who will say that the expectation value of an accident that happens on the average only once in 10,000 years (but when it does happen is very, very bad, and could happen next year, as likely as in the 10,000th year) is not comparable with a 10,000 times less severe accident that happens on the average of once a year. Aggregating big and small events is not a very meaningful basis on whch to make the judgment regarding that particular risk. If you add routine risks and expectation values of catastrophic risks you've got an aggregate number that conceals a whole set of very fundamental value judgments. So my own point of view on this is that you cannot really go beyond a certain point in aggregating costs and benefits. You are only obfuscating the fundamental value issues that underly the debate.

In the energy study which I recently co-chaired for the National Academy of Sciences, we had a risk panel which started out with the idea that they could do just what you were suggesting, but they concluded that the best way to present the risks was to develop a typology of risks: catastrophic risks, delayed deaths, occupational accidents, deaths from cancer, and so on, and to compare different energy systems separately with respect to each of these types of risks and present them all in a matrix. The public then has to decide based on their relative aversion to the different kinds of risks. There is no "scientific" way of weighting the different kinds of risks in this aggregation. The public must look at each type of risk and decide how it values it. In other words, you can compare, for example, the risk of a hydro-electric dam which may break and kill a lot of people with a catastrophic nuclear accident, but you can't compare a catastrophic nuclear accident with the loss of an ecological habitat that results from a hydro-electric dam or the effect of strip mining coal. In other words, different people will have different ways of comparing these apples and oranges which are always involved in risk estimation.

Question: Do you feel we can last without nuclear energy?

Answer: It's very hard to answer that question categorically. It certainly will be a lot harder to last without nuclear energy than with it, but I would not be prepared to say that we can't last without it. We'd be in real trouble if we shut down all nuclear plants tomorrow, but we could probably phase them all down over a period of years with resulting escalation of energy costs but no economic catastrophe, at least in the absence of other events such as a sudden reduction in Middle East oil output.

Question: Would a severe energy shortage cause people to be more favorably disposed to nuclear power?

Answer: That's an interesting point and may be true.

If we had a really rip-roaring energy shortage with brown-outs all over the country and hospitals having their power shut off and so on, I think peoples' attitudes towards nuclear power might change. I'm not predicting that that will happen, but I'm predicting that if that did happen it would certainly change peoples' attitudes.

Question: In the State of New Hampshire with about 400,000 voters and 424 legislators trying to assess or put values on the matrix you've just described, how would you try to balance that? Can you leave most of that balancing to the legislators, or have you got to turn an awful lot of that over to the public?

Answer: I guess my own inclination is that you have to turn it over to representative people because those are the only people who at least have some chance of spending sufficient time to learn enough about it to make a reasonable decision. If you had a guarantee that all the public would study the issues sufficiently closely so that all votes were, you might say, based on an equal amount of information and understanding, then I'd trust the public; but I think that's an unrealistic expectation. I think a very good example of a process which worked pretty well — that was very much feared as a matter of fact by the scientists — was the whole situation with the City Council in Cambridge, Massachusetts, regarding recombinant DNA research at the Universities. The City Council set up a citizens group, which was a group of representative people from the community with no particular expertise on the subject of recombinant DNA research, but they took the time to listen to all sides of the argument and to really think about it, and they came up with what I think was a very reasonable and informed decision. They were a representative group,

but they spent the time to learn what was really known about the issue. I think that's the only model on which a democracy can really work. I just don't believe you can submit every question to public referenda. You're not likely to get a very good decision if you do.

Question: What do you think about the possibility of what I call "experimental legislation", that is, the legislature decides that we're going to try this. Now it's only going to be three years old and we're going to take data and we'll see how the courts interpret it if indeed the courts are going to have the power to interpret it. But it's not going to become permanent law. We're going to see what it is and then we're going to legislate again. Do you think that's feasible.

Answer: Well, I guess I throw the question back at you as a lawyer — but it appeals to me.

Response: It's something against the lawyers concept and the legislators concept, but I see no other analogy to this.

Answer: Let me say — you know that's what we've actually done in a number of cases but we haven't admitted it. If you look at the whole history of automobile emission legislation, that's precisely what we've done. In fact we've arrived at almost precisely the point that we were when the Nixon administration made its original proposals for automobile emission standards just before the "clean air" amendments of 1970. We've followed almost exactly the timetable and the standards that were recommended by the experts at that time until the whole process got politicized because of Muskie's presidential aspirations. What has happened instead is a whole series of confrontations between the industry, the legislature and the courts which has resulted in successive amendments to the law which have followed almost exactly the path which might have been thought to make technical sense in 1970. And so we really did follow an experimental process — only we pretended it wasn't an experimental process.

Question: A blatant example of this would be NOW accounts that were introduced in Massachusetts, New Hampshire and a few other Northeastern states — just to test them out! I'm surprised someone didn't bring an equal protection case against them!

Answer: That's a very good example. As a matter of fact, one of the things I've proposed with respect to some of these conservation questions that I've talked about — and would apply in the case of integration of renewable resources into power grids — is that, instead of passing national legislation, one deliberately set up more or less controlled experiments in limited areas with different legislation in dif-

ferent areas and see what happens. I made a specific proposal on this for example with respect to co-generation and to utility regulations surrounding co-generation — that one simply just try the thing out in a state or even a smaller region. You change the incentives and so on and see what happens.

A very good example, by the way, of how important this process can be is the whole history of airline deregulation. There is nothing like an existence theorem to convince people that you can do something. The airline industry was unanimously opposed to airline deregulation, and the thing that actually convinced people to adopt airline deregulation were two accidental controlled experiments in Texas and California; and they were purely fortuitous experiments resulting from the fact that these were big enough states so that you had an airline that operated only within a single state and was therefore not regulated. That was the most persuasive argument in the Congress and in other parts of the government, as well as with some airlines executives, that the larger experiment was worth trying. Moreover, experience with the airlines has provided arguments for deregulation of other industries such as trucking and railroads.

THE RELATIONSHIP BETWEEN LAW AND SCIENCE, PART II*

HUGH GIBBONS**

PART II. Six Representations of the Law/Science Relationship

A review of the law/science literature reveals a large number of people who are concerned about problems in this relationship, but none who describe the relationship itself. Is law a set of traffic signals that direct science and technology along the path of civilization? Or is law a safe harbor, protecting us from the ill effects of science and technology as they plow along their own mighty course? Or is law itself a form of technology, used to conform human beings to a grander social plan embodied in scientific progress? The intent of this part of the paper is to provide a framework for answering those questions.

This effort is plagued by two difficulties. First, we must work at truly dreadful levels of generalization. The phenomena that we seek to interrelate — law, science and technology — are themselves titanic generalizations. All we can hope to do is lay out a general framework that will orient our observations, allowing us to fill in the blanks and later test the generalizations.

The second difficulty is that we are attempting to relate apples to oranges. At a sufficiently general level we could say that law, science and technology are similar in that each is a system — a (loosely) ordered set of relationships among people functioning toward a common purpose. But that would wash out the differences between them that are of interest. That interest lies at the level of the different purposes that animate them. The difference is this: Science and technology *embody* values; law does not. Law is a transmission system, taking values from a source (e.g., the Constitution, tradition, the political process) and using them to control behavior. It is relatively easy to compare law with other systems that *transmit* values, such as

*This article is the second of a four part series. Part I, *The Law/Science Problem,* was published in the last issue of IDEA. Parts III and IV will be printed in the next two issues of IDEA.

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the market process or the political system.[1] It is very difficult to relate law to a system that embodies values. Law is supposed to control these systems, to guide them by transmitting values to them. We are not describing a mechanical relationship, but a normative one.

The difference between a value-embodying system and a value-transmitting system explains some of the difference between scientists and lawyers. The scientist is involved in the thing itself, providing knowledge which is of value to himself and (if he is not off on a toot) to others. The lawyer is not. The value which he pursues is the value of transmitting values to others. He lacks that sure click of satisfaction that comes from a job well-done. When he does a job it is always *for* someone else; his satisfaction must stem from protecting the values of another from exploitation.

The six paradigms that follow relate law to science in a purposeful way, based upon the proposition that the function of the legal system is to take in values and use them to control behavior. The questions that each paradigm answers are these: Where do the values come from that law uses to control science and technology? How does it implement those values? It is effective? Here follow six snapshots of what is hopefully one elephant.

1. Law Constrains Science and Technology, Just as it Constrains All Other Behavior.

For the most part, law treats scientific and technological behavior the same way that it treats everything else. A scientist who seeks employment is governed by the same contract law as a teacher; an inventor who accidentially blows up his neighbor's house is governed by the same tort law as an excavator who does the same thing. In both cases the law places the responsibility upon an actor to internalize the effects of his behavior.

When it acts in this way, law is applying what we will term *parametric values* to the control of behavior. Individuals determine their own *driving values,*[2] the purposes that motivate their behavior.

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[1] *See, for example,* Richard Posner's comparison of the market, common law, legislative and administrative processes in *Economic Analysis of Law,* 2nd ed., Boston, Little Brown 1977.

[2] The distinction between parametric and driving values made here has numerous analogs in scientific theory, of which Freud's distinction between the superego and the id is perhaps the most well-known. The superego performs a parametric function, constraining the driving force of the id. Similarly, an electronic music synthesizer has both program signals, which contain the musical information itself and are analogous to driving values, the control signals that process and direct the program signals.

They pursue their purposes subject to the constraints of parametric values. In this society we may take the general statement of parametric values to be this: Each person may do what he will, so long as he does not hurt others in the process. Each person is entitled to his own purposes, so an attempt by one person to constrain or trick another is sanctioned by law. But each person must, in the pursuit of his aims, respect the same right in others.

The laws that spell out this principle do, of course, vary depending upon the activities that people undertake. Dynamiters and soccer players are subject to different rules because of the greater dangers presented by dynamite and because of the fact that those who are at risk in soccer are at risk voluntarily. Similarly, science and technology fall under special rules applicable only to them. The pharmaceutical company, for instance, is under far tighter constraints than other firms. It must gain premarket clearance of the safety and efficacy of its new drugs by the FDA, where the firm that wants to introduce a new type of radial arm saw need not. This is not, however, because different parametric values are applied to drug makers than saw makers but because the nature of drugs and saws warrants a tighter set of constraints in the one case than in the other. The state is required (by the parametric meta-value of equal protection of the laws) to apply the same parametric values to every activity, justifying different rules on the basis of actual differences between the activities being controlled. So the more stringent control of pharmaceuticals had to be justified by a demonstration that they have long-term dangers which the consumer could not discover until too late.

Similarly, the patent laws, which seem to give a special property right to inventors that other people do not have in their ideas, is justified (it is felt) by the fact that ordinary property rules do not offer sufficient protection in a situation where great investments of time and money are required to convert an idea into a product.[3] Viewed in this way, the patent law is not a special rule to favor technologists but simply one of a number of rules to protect people caught in the same bind, just like the mineral claim rules which protect a prospector who discovers gold or silver.

This relationship between law and science may be pictured in the following way:

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[3] Kitch, *The Nature and Functions of the Patent System,* 20 Jour. Law and Econ. 265 (1977).

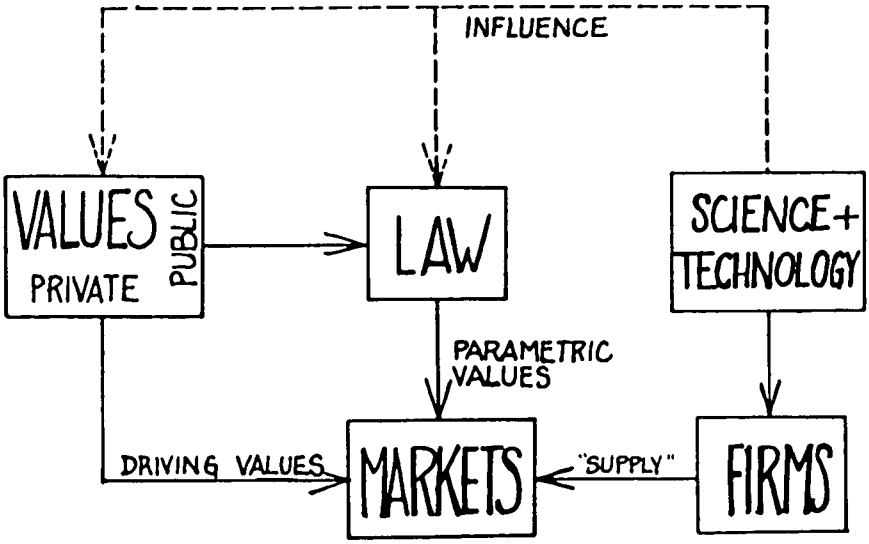

Figure 1

In this paradigm, driving values operate on science and technology in two ways. First, they *pull* in the form of demand. People are willing to "pay," in a broad sense, for technological advance by paying more for products or services that more nearly satisfy their wishes. Technological improvement is delivered by suppliers who hire engineers and scientists to build it into their products. Second, scientific and technological progress is *pushed* by individuals who value it in and of itself. Much progress is done by people who were not in it for the money.

In this situation, the only role of the law is to supply a stable set of parameters within which this interaction can take place. It supplies property rights so that people have something to exchange (e.g., time for things), contract rules that enable them to do it, and tort rules that tidy up the occasional mess that they make of it.

The relationship between law and science is reflexive, as indicated by the dotted lines. The information generated by science and technology feed back and alter both values and the legal process itself. Science shapes values by changing the popular understanding of nature, in some cases bringing down entire belief systems, as in the case of the theory of evolution. Technological development changes values by reducing the cost of some behavior — so that improvements in

medical technology that reduced the cost and risk of abortion had a strong role in changing attitudes toward it — or by making possible new behavior — so the revolution in attitudes toward sexual behavior in the 1960s is partially attributable to the invention of the pill and the I.U.D. The ethos of materialism itself is attributed by some to technological development.

Science and technology also feed back into the legal system. The law has been the subject of intense interest by economists and sociologists. Their findings have had considerable impact upon law, for instance in the development of highly sophisticated jury selection techniques by sociologists and in extensive suggestions for legal reform by economists. New technology has made an impact on the way trials are conducted (e.g., video trials), truth unearthed (e.g., drunkometer, lie detector), evidence presented (e.g., expert witnesses, statistical information), law researched (e.g., Lexis and Westlaw), and on and on.

With both values and the legal system under the control (to some extent) of science and technology, there is reason to wonder whether or not science and technology are entirely value neutral — so that they don't "care" how the values come out. It is assumed under this paradigm that they are value neutral, so that the only value driver is the individuals from whom values flow in some democratic fashion. We will take up the contrary thesis, that science and technology somehow embody values purposively, in paradigm 3.

The import of paradigm 1 is that, to the extent that it is accurate, there is no unique law/science problem. As with any area of law, circumstances change and laws must change with it. There must be lawyers who are expert in science, just as there are lawyers expert in art, international trade and sports, for rules must be tailored and battles resolved by people who know what they're talking about. But the essential value job to be done is no different. It simply amounts to applying parametric values to behavior.

The job of law/science, under this paradigm, is to: 1) Identify areas in which traditional rules of law must be adjusted due to changes in the social environment brought about by technology; 2) Devise more effective ways to protect people from the unforseen harms of change; 3) Make the system work by bringing scientific expertise to the judicial and administrative processes. Educating the law/scientist is a matter of giving him a firm foundation in the legal process and directing him to specific areas in law where his experience will be most advantageous.

Consider now how the new genetic engineering technologies will be

handled if they are treated in a paradigm 1 sort of way. The values that drive them, that determine whether or not they are in fact utilized, will be individual values acting individually. So pregnant women will decide whether or not to have amniocentesis and then whether or not to abort or elect genetic manipulation of the child. Doctors and scientists will determine individually, or perhaps as part of a self-policing group, whether or not they want to take part in these techniques. The only role of law will be to see that no one is "hurt" along the way, so tort law will force doctors to use the best available technology and regulations will force full disclosure of the risks of the new techniques. Law will transmit no substantive value decision to the process. If patients and doctors decide to implement genetic engineering, it will be done.

It is unlikely that the new technology will be implemented in this way. The extent of individual decision will be cut down, though not necessarily obliterated, by collective decisions transmitted through law. There are good, as well as bad, reasons for this. For instance, the law in paradigm 1 is geared toward individual transactions. In situations where individual transactions may be perfectly fair, but the aggregate effect of those individual decisions in disastrous, paradigm 1 offers insufficient protection. The parametric role of law is adequate where simply forcing people not to hurt each other as they go about their business is suficient protection. For most of history — and for most of life today — that was sufficient. But as technology has created ever more powerful tools, with subtle and distant effects, avoiding present harm is not sufficient. The aggregate effect of individual decisions on genetic engineering may be cataclysmic. There are those who claim that it has already happened, that medical care has permitted people to reproduce who would not have been able to, resulting in a decline in the quality of the gene pool.

To cope with the aggregate and hidden[4] effects of technology a new role of law is required.

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[4] Technological progress is generally accompanied by increased complexity. Complexity raises information costs, making it necessary for each person to study longer and harder to inform himself of any given phenomenon. Since technology has not been able to either create more time or more intelligence, individual transactions become increasingly suspect as it becomes obvious that the parties to the transaction are increasingly ignorant about it, relative to the amount of information available. The result is a shift of power from individuals to centralized organizations in order to economize on information costs. *See* Daniel T. Spreng and Alvin M. Weinberg, *Time and Decentralization,* 109 Daedalus 137 (Winter 1980).

2. The Society Uses Law to Drive Science and Technology.

Prior to World War II, paradigm 1 might have been an adequate representation of the law/science relationship. Science and technology were financed almost entirely by private sources. Where public funds were involved, as with the design of military aircraft, it was in situations where government was providing a service quite analogous to private services. Government "bought" science and technology where that was necessary in order to do its job, just as GM bought it to develop automobiles. This was a paradigm 1 relationship.

Since World War II that has changed. Scientific research is overwhelmingly funded by the state and technological development very substantially so. Science and technology have *themselves* become a public good. When the NSF funds research into rabbit eye-blinking behavior or the NIH funds research into genetic engineering it is not because those agencies have a substantive interest in rabbit eyes or chromosomes. It is not entirely clear why they should be doing it.[5] But it is clear that law is here being used in a very different way than paradigm 1. It is being used as the vehicle for the transmission of direction to the scientific process.

Figure 2 represents this new relationship.

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[5] The standard economic justification of public expenditures is the avoidance of the freerider and holdout problems. That is what justified the patent system — preventing imitators from free riding on the efforts of innovators. Apparently, however, that was ineffective, so that governmental expenditures are necessary to supplement a flawed market process. The political justification — that science and technology are funded by a democratically elected legislature — does not entirely slam the door on the question.

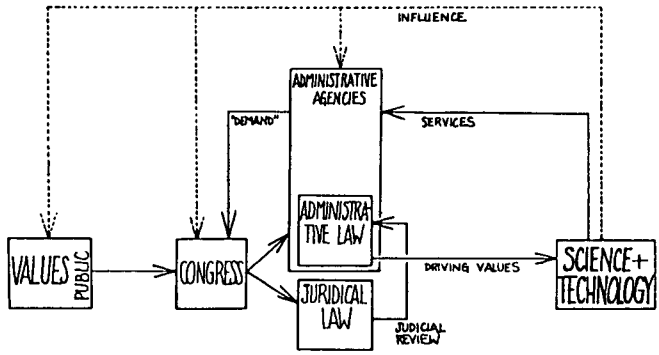

Figure 2*

*The material from Figure 1 is left out of Figure 2 for clarity, not because it has ceased to exist. Paradigm 1 constitutes the "lower loop" of the law/science relationship and paradigm 2 the "upper loop."

Let us trace through the system. Congress receives value statements and on the basis of them enacts statutes. These values enter from a variety of sources: from the legislator's personal values; from statements by constituents; from influential organizations; and from governmental agencies themselves. Congress enacts legislation directing agencies to act and providing funds to do so. These acts are generally very broad, conveying considerable discretion to administrative agencies, though they may be decisive, as in the case of the congressional termination of development of the B1 bomber.

The agencies then formulate a second set of laws. These laws may be in the form of policies that direct the funding of science and technology. They may be "technology-forcing" regulations, as with the EPA standards for automobile exhaust emissions which forced the auto makers to invent new emission control systems. They may be direct constraints upon research, as with the NIH standards for genetic research. They may be promotional regulations, offering subsidies for certain development or for the transfer of technology to another country. They may be substantive decisions in specific cases that affect the implementation of specific technology, as with licensing decisions on nuclear power plants.

The laws promulgated by administrative agencies direct science and technology in a great many ways. There is at present no adequate description of this process, let alone an assessment of it. It is clear, however, that the agencies exert great control. A rough index of its magnitude might be the number of flights in and out of Dulles International by people holding a PhD in science.

Agency laws control both the substance and process of science and technology — they direct what is done and how it is done. Much of what is done is of direct benefit to the agencies in their jobs, as when oceanographers conduct studies that will be used to establish stan-

dards to regulate offshore oil mining. A great part of it, however, is of more general benefit, as with funding of basic research or of technological development to help specific industries such as agriculture or aerospace.

As with paradigm 1, science and technology feed back into the control system. The pattern of their influence upon public values is the same as paradigm 1, but here we add two connections that did not exist there: the connections to Congress and to the agencies. World War II established the public importance of science and technology,[6] and the Russian launch of Sputnik reinforced that importance. Scientists became people who could do something for politicians, so their influence grew. They became an important *source* of values in Congress, their opinions given a weight disproportionate to their numbers. As Congress became a buyer of science and technology, political influence became an essential marketing device for research and development organizations. The deft lobbiest could fashion laws which directed benefits to his organization with a minimum of administrative red tape in between.

Similarly, research organizations developed a close-working relationship with the agencies that were controlling them. This relationship has been characterized as one between patron and client.[7] Both patron and client share an interest in the largess of Congress, so to the political influence of research organizations is added the demand of administrative agencies for greater funds and control. The agencies represent the client, for their power derives from its success. Patron and client become close, every agency employing outside boards of scientists and technologists to guide its policies and inside staffs of scientists and technologists to monitor and evaluate its subjects.

The "new law" of the administrative agencies differs greatly from the "old law" outlined in paradigm 1. Both are "law" in the sense that they allocate the coercive power of the state: Violation of a regulation brings down the power of the state just as sternly as violation of a tort law. But "old law" operated by the creation of rights while "new law" operates by the administration of rules. Enforcement of administrative laws is by public administrators, not by private plaintiffs making a claim of right. Notions of the "public good" animate law under paradigm 2, where it was the idea of justice that animated the

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[6] C.P. Snow offers the most enchanting account of this process in novels such as *Corridors of Power*.

[7] Theodore Lowi, *The End of Liberalism*, New York, W.W. Norton & Co., Inc., 1969, pp. 93ff.

parametric law of paradigm 1. The new law is not a medium in which lawyers feel particularly comfortable, since they were trained in making claims of right. They become wielders of influence, adept at getting regulations drafted that favor their clients, prospering according to their ability to swing administrative discretion in the direction of their clients.

It is important to point out that old law is not entirely absent from paradigm 2. The agencies are not rights-driven, as the courts are. But they are rights-limited. Their discretion is bounded by the Constitution, by the congressional enabling act that created them and by the Administrative Procedure Act. Where they act outside of those limits, a plaintiff may make a claim of right. A plaintiff may, for instance, claim that an agency abused its discretion, or took his property without compensation, or failed to accord him due process. This triggers the judicial process to a review of the agency.

The new law is bounded in this way by the old law. But there are serious limits on these bounds when it comes to the judicial review of scientific and technological questions. These questions are so complex that it is simply not possible for a court to review their substance. No court, for instance, would touch the claim by a draftee that the draft was unjust because it forced him to fight an unjust war. That is a political question. Questions of science policy are, like questions of war policy, outside of the ambit of review. But even on review of procedural matters the courts are inadequate to the task. The record of administrative proceedings is typically thousands of pages long and written in a language that is almost unintelligible to the uninitiated.[8]

Lawyers are, by training, resolutely parametric in outlook. They orient their thinking by looking for rights. The quintessential model of the law is the defendant in a criminal case who is being railroaded by a district attorney. As cases depart ever further from that model, rights become difficult to fathom. The Supreme Court grinds endless refinements on criminal rights, to the point of defining under precisely what conditions a police officer may look into the trunk of a car for evidence of wrongdoing. On complex scientific and technological matters the Court says very little. Questions about the licensing of

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[8] Judge Harold Leventhal, well-known for his expertise on technological issues, suggested that judges be provided with clerks who were trained in science and could translate technical language in, *Environmental Decisionmaking and the Role of the Courts*, 122 Univ. Pa. L. Rev. 509 (1974). He also argued against the designation of a special science court, saying that special interest groups would focus upon it and political forces would tear it apart.

nuclear reactors, for instance, are avoided wherever possible and handled on narrow procedural ground when that is not possible.

As law changes from a parametric to a driving role in science and technology, lawyers are forced to devise new ways of thinking, not based upon rights. That is a slow process. In a paradigm 2 world the law/scientist has a far more difficult job to do than in a paradigm 1 world. Trying to devise more effective mechanisms for the judicial review of administrative agencies is just the beginning of the task.

Consider how genetic engineering might be handled in a paradigm 2 world. We have seen that under paradigm 1 the only function of law is to see to it that those who are involved in it don't hurt each other or spill costs over onto others. Properly constrained, doctors and patients worked out between themselves how amniocentesis, cloning, etc., would be used. Under paradigm 2, the state goes much further. It determines what these techniques are *for* and then drives that purpose through law. So Congress conducts hearings into the public purpose of genetics engineering and finds, shall we say, the following.

First, if the use of these techniques is left up to individual decisions the genetic makeup of future generations will be dramatically altered. This can't be allowed to happen willy-nilly, so public control of the process is legitimate. Some testify that the state should ban these techniques because they are offensive to God. But there are others who demonstrate that the techniques can dramatically advance the public good: The avoidance of defectives would eliminate not only great private tragedy but also much of the burden of funding HEW remedial programs; genetic predisposition to some diseases could be designed out of the population and perhaps even some of the psychological tendency toward violence and crime; and national defense would be protected since there is no way of telling whether the Russians are now developing literal frogmen who can swim under water for hundreds of miles.

Pursuant to these considerations, Congress creates the Genetic Manipulation Authority. It is bound to, "Pursue the public interest in genetic manipulation techniques," through the funding of research, funding of the application of the technology, licensing its practitioners, and so on. Could the Authority adopt regulations which require pregnant women to undergo amniocentesis and either abort the defective fetus or have it genetically cleaned up? That is one of the first cases to arise under the act. The court looks in vain for guidance. The Constitution says precisely nothing about anyone's right to bear children. But that is surely covered in a penumbra to one of the Bill of Rights; but the Supreme Court has said nothing about it. But the

question is not whether a woman has a right to bear children but whether this woman has a right to bear a *defective* child. Surely that is different. What does the enabling act say? That the Authority can make such rules as are in the public interest. What does that mean? The Authority says that this rule *is* in the public interest and that it has four Novel Laureates who say so. What do they say? "Where, as in this case, a mother herself evinces such severe genetic deficiencies as to be able to survive only through welfare payments, her offspring will break out of the welfare cycle only if they have a genetically favorable endowment. The means exist to avoid yet another poorly endowed generation. Those means must be used." The record contains seven thousand page of testimony and statistics to that effect.

In such a situation as this, which is fanciful though not whimsical, rights are not a lively guide.[9] Guidance is supplied by expertise. The decision is wrapped up in the job of describing what is. The law of paradigm 2 is not the law of justice and rights. It is the law of the public interest and expertise, the domain of the policy analyst, the cost-benefit assessor and the technical expert. Law itself becomes technique, a way of formulating a set of control signals for orienting behavior according to a common plan. Within the common plan the question of what ought to be is easily answered. It is the common good. The difficult questions are the technical ones: how best to achieve the common good in this technical situation?

The difference between paradigm 1 and paradigm 2 is what John Rawls has called the difference between a system of pure justice and a system of perfect justice.[10] In a system of pure justice and end result of human action is not specified, but a fair process of human interaction is defined. The example that he uses is a poker game. Each player plays under the same rules, which makes it fair. The results of the game, the distribution of wins and losses, are whatever they will be, given the laws of chance and the skills of the players. In a pure system, the results of interaction are under the control of each of the participants, to the greatest extent possible. The rules of poker, like the rules of law in paradigm 1, are parametric. They establish the basis of interaction and leave the outcome to the play.

In a system of perfect justice the desired outcome is specified and the task is to define the set of rules to achieve it. Rawls' example is

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[9] C. Lester Gaylord, tongue-in-cheek, describes the inability of traditional rights concepts to illuminate the genetic engineering problem in *The Man in the Only Business With a Future,* 85 Case and Comment 38 (Sept.-Oct. 1980).

[10] John Rawls, *A Theory of Justice,* Cambridge, Harvard Univ. Press. 1971, pp. 85ff.

the process of splitting up the remainder of a pie between four hungry children. The objective is that each child have the same size piece. The rule that achieves that objective: the child who cuts the pie will be the last to select a piece. This is the role of law in paradigm 2.

When law became a driver of end values to science and technology it became a tool for delivering upon a given objective. Who specifies the objective? In the pie example it was the parent, and we (probably) assumed that that was just because we have some sense of property ownership and of the proper politics of the family. But what of society as a whole? Are the end-state objectives that drive science and technology put there by the democratic process? Or is there some sort of feedback process by which science and technology themselves create the desired end state, so that the law which appears to control them is in reality simply delivering rules which achieve their purposes? There are many who fear that this is true. We will take this up in the next paradigm.

3. Science and Technology Use Law to Control People to Their Objectives.

To this point we have assumed that individual values, attitudes or desires are the base datum of social existence. The question in paradigms 1 and 2 was how the law is used to make science and technology what we want it to be. Now we consider the possibility that that is self-delusion, that it is not human ends acting (in part) through law that drive science and technology, but science and technology acting (in part) through law that drive human behavior. If this is to have any plausibility, we must avoid attributing any motivational power to the institutions of science and technology themselves. We may occasionlly slip into anthropomorphism ("Science and technology want . . ."), but we must be able to describe how it is that individual human motivations make this process go.

There are many ways of conceptualizing science and technology as a driving force. I will use the one that views it from an evolutionary perspective.

Evolution may be thought of as proceeding in three phases. The first was chemogenic — the development of complex atoms and molecules out of the primordial mass of hydrogen that was once earth. There was no purpose in this process, at least not one that can be discerned. There is no need to posit a purpose in it, just as one can understand a ball rolling downhill without posting a homunculus inside making it go.

With time, molecules emerged that were complex enough to sup-

port life. The second, or biogenic, phase began: the evolution of complex organisms, resulting in man. With man, two things happened. First, man altered his environment so fast that biogenic evolution, in essence, stopped. Selection couldn't operate fast enough to improve on *Homo sapiens*. Second, the evolutionary process passed to social organizations. If people could not improve biologically, their behavior could improve (in the sense of its power to extract support from the environment) through social organization. Individuals became components of evolving social structures, at first the family, then the tribe and so on to modern, large-scale organizations. Genetic information became increasingly feeble as a controller of human behavior and had to be supplemented with information in words. Words, in the form of norms, roles and laws, became the information that coordinated people within organizations, just as neural impulses coordinate the cells of the body.

The evolution of large-scale organizations is closely analogous to the evolution of large-scale organisms during the biogenic phase. The Third Reich failed in its competition with the Allies in the same sense that *Australopithecus* failed in his competition with *Homo sapiens*. And primitive cultures fail in the face of modernity in the same way as the snail darter. There simply is not room for either in the modern world unless they are protected as pets.

With social organization, individuals thrive in proportion to their connection to it. Individuals mature and die. Organizations evolve, saving and coordinating the information contributed by individuals. Where the organizational fails to capitalize upon the most powerful information, it fails in competition with those that do, as the Polish Horse Cavalry found in World War II.

What we call science and technology is simply the growing edge of organization — its increasing ability to profit from its environment. The organization's survival is threatened by other organizations, by the failure of natural resources, and by a lack of support from its members. When it responds to those threats we call the result weapons technology, materials science and motivation engineering. Technology is to organizations, in other words, what mutation and the random pairing of chromosomes in the ovum were to biogenic evolution: an internal change in the organism which, if successful, allows it to exert more powerful control over its environment. The evolution of the hand is directly analogous to the development of the back hoe; and the evolution of the central nervous system in analogous to the development of computers. Science is the intelligent analog of mutation, and technology is the analog of cellular reproduction

that turns the new genetic information into a different form of organism.

An evolutionary process is not driven by intention — it is not *for* anything. But this evolutionary process must cope with intention, for its components are human. That is the role of law. A system composed of witless parts may operate with messages that contain but naked information. Your furnace does not ask, "Why?" when the thermostat tells it to fire up. But a system composed of willed parts must not only convey information but also cope with the intervening will. That is what distinguishes law from the messages that go to the furnace. Law must convey both the signal to act and the reason why that signal should be followed. The simplest reason why is that pain will accompany any failure to follow the signal. But law conveys more. It conveys a sense of legitimacy. An order of court or of an administrative agency carries with it a legitimacy that a request from a neighbor doesn't have.

Law, then, is a system for controlling the willed components of organization. Technology is our name for a change in organization that gives it greater control over its environment and its components (so an improvement in law is itself technology, where "improvement" means a modification of law that more tightly bonds a person to organization — such as the pension plan). And science is the systematic application of intelligence to produce change. This relationship may be pictured in the following way:

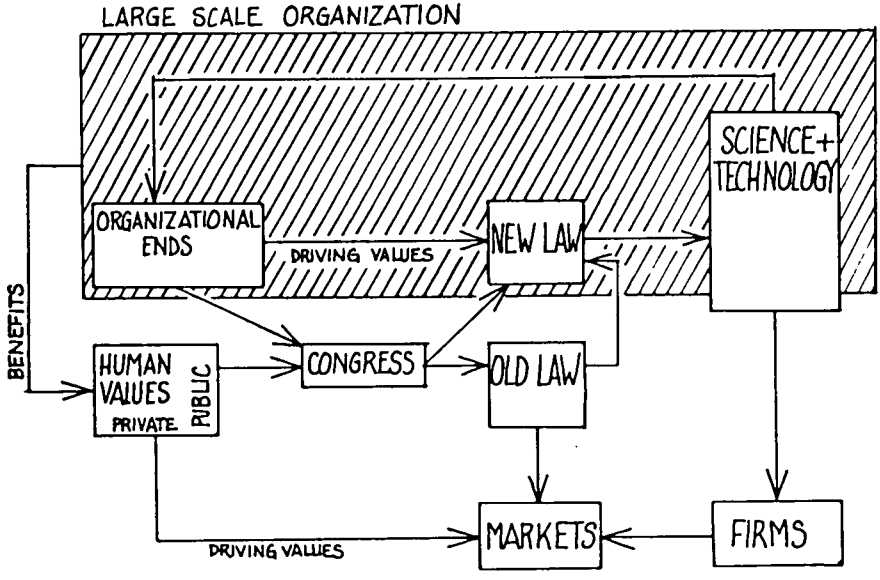

Figure 3

The lower loop of Figure 3 is paradigm 1. It reappears here because, under this view, the job of integrating a society through laws was an earlier stage in the evolutionary process which is not yet final. The word "society" signifies a lower level of organization, a looser set of connections between people and institutions. The organizing principle of law in the age of "society" was justice, the pure justice of parametric values. But under that principle, which took individual aims as sovereign, social integration could proceed only so far. A society of individuals could be integrated by law, but not driven by law.

The upper loop represents the more recent stage of evolution. The "society" has become the "state," a higher level of integration under centralized authority. Law has become the driver of behavior. And science and technology have been the thing that have made the upper loop possible. They provided the high level of productivity that freed people from the daily production of things so that they had time to supervise each other. They provided the information and communication systems that turned the dream of the continual surveillance of every member of society into a real possibility. They provided the rationale for taking decisions out of the hands of individuals and placing them in bureaus. And they provided the stream of material benefits that made it all worthwhile to the individuals involved.

The upper loop is very similar to the representation of paradigm 2 in Figure 2 — with one major difference: The driving force of the upper loop is not human values but organizational ends. It becomes critical to understand them and to avoid anthropomorphism. We are used to thinking of organizations as motivated by human controllers, so Hitler gets command of the German government and all hell breaks loose. That is a paradigm 1 type of problem. The solution (a problematic one), is the adoption of a set of parametric rules called "democracy." The "organizational ends" that we specify in Figure 3 are not this sort of end. They are not intentions; they are dumb.

A ball sitting at the top of a hill does not "want" to reach the bottom, yet, if the conditions are right, it will. It behaves according to the force of natural laws. If it can bounce down the hill, it will. That (at least under this paradigm) is the way it is with organizations. If they can grow in power over their contingencies, they will. A ball awaits an outside force to jar it on its way. Similarly, organization awaits an outside force to lay open for it further expansion of its power. That outside force may be another organization, weakening in internal integrity and inviting invasion. Or that force may be human intelligence, which sees the possibility of using electric wires to communicate information. The human side of the process is the insight that one has

the opportunity to organize, to use the telephone to create a corporation by allowing previously disparate people to communicate. The corporation, once formed, will organize the efforts of its members. They will, themselves, embody the logic and ends of organization, identifying with it as their own well-being, becoming their roles. They will define success as the growth of organization, the integration of more workers and customers, citizens and officials.

The dumb force of organization fits very well with the intention of individuals to organize, to seek power over things and others. But it does not derive from that. It derives from the fact that human interaction is itself organization, just as cellular interaction is itself the organism. The interior logic of organisms and organizations is the same: specialization of labor; redundancy of function; unencumbered flow of information.

Law changes to adjust organization to a changed environment and changed internal opportunities. It reorganizes individuals to capitalize on new technology. So when it became possible to generate electricity by nuclear power, the electrical utilities were shielded from tort liability by the Price-Anderson Act. When the demand for able workers arose in the later stages of industrialization, there came the fair employment opportunity acts and objective job placement tests. And when the organizational sciences became sophisticated, administrative agencies were substituted for legislatures as a source of law.

According to this paradigm, the higher form of organization of the upper loop will drive out the lower loop. Regulation will be substituted for adjudication; rules will replace rights. Expertise will be substituted for public opinion, administrative agencies for courts and legislatures. Organizational ends will be substituted for human values. It is possible to objectively assess which policies will favor organizations, but not which values are right. As decision making becomes more "scientific," it becomes more organizational.

A number of factors limit the shift from lower to upper loop. One is the slow pace of science and technology itself. Information science may never find an adequate substitute for the market for allocating scarce resources, in which case the private property system — and paradigm 1 — will be with us forever. Another limitation is the law. It is a very imperfect form of control. One would expect to see hard technology substituted for law whenever possible, so that criminal behavior will be avoided by electronic monitoring instead of the criminal law. A third limitation is the flow of benefits. That is the *sine qua non* of large-scale organizations: They deliver the goods. As

natural resources are exhausted and food supplies become inadequate, it is not possible to free up the number of human beings needed for large-scale organization.

A fourth limitation is human values — many people do not favor the rationalized world of the upper loop. They would use law to dominate organizations, to direct them according to human ends. To them, the ideal level of organization is less than total organization, and less than the bounds provided by science and technology. There is technology which is available but should not be used. Law must act as the control, selecting those changes which are good and suppressing those that aren't.

We will take this up in the next paradigm, but first we must ask if it matters. Are human values an interesting subject? If the growth of organization is truly an evolutionary process, values are within it — part of the engine that makes it go. Values give organizations their color and shape them as they come into conflict with one another. But they can't get outside of the process, directing change itself. The members of an organization can, in the short run, prevent it from changing, but by doing so they are simply killing it. To survive, organization must capitalize maximally upon science and technology; it must become as powerful as it can be. To direct it intentionally, cutting off avenues that it could go down, is to kill it. Ironically, individuals will only hurt themselves by trying to control organization. No single organization "cares" if it survives. The process of organization is entirely dumb to the well-being of any particular organization. The only ones who care are the individuals who are attached to the organization as it fails. An attempt to control organization can only lead to pain.

Paradigm 3 is determinism with teeth. A more polite form of determinism would say that you can attempt to change things but you can't succeed. Paradigm 3 says not only that you can't succeed, but any attempt to do so will produce pain. To attempt to limit computer technology by the value of privacy or to limit genetic manipulation by the idea of human sanctity is to court disaster. Unencumbered by these sensibilities, the Russians will overwhelm us. Or a future natural disaster which could have been avoided will drive us back to the stone age.

The bite is deeper than that. Science and technology have provided organization with the means of avoiding the limitation of will. They can substitute machines for people (advances in artificial intelligence, for example, reduce the number of human supervisors that a system must have in order to increase in complexity), program volition

through such techniques as advertising and behavior modification, and perhaps even avoid volition altogether through the judicious applications of genetic engineering. The "they" in that sentence refers to people. Organizations are themselves, of course, indifferent on the subject. But those who make them run have a stake in their continued prosperity. Science and technology give them the tools to protect that stake and the logic to make it sound sensible.

If paradigm 3 is accurate, the job of the law/scientist is to see to it that rights do not hamstring science and technology, to see to it that the upper loop remains isolated from the lower loop. Law must be used to produce social change that facilitates the adoption of new technology, and it must be streamlined so that the financial support of science and technology is not bumbled by bureaucracy.

4. Human Values Act Through Law to Constrain Organization.

Paradigm 3 is, from the standpoint of human values, the dark underbelly of paradigm 2. The use of government in paradigm 2 to direct science and technology is seen not as an attempt to assert human values but as a way of locking science and technology into servitude to organizational ends. The job of law, under paradigm 4, is to control organization itself, conforming it to human ends.

In this view, science and technology have given birth to a new political age. In the first age, which stretched from the birth of civilization to World War II, the task was to prevent the state from being dominated by private ends — the ends of the monarch, the theocrat, the maximum ruler. It painfully produced democracy, constitutions and the rule of law. That age passes into the age of administration, where the task is to control organizations, newly animated by affluence and integrated by modern communications. The problem is no longer personifiable — it won't do to simply look out for dictators of evil mien. The danger lies in the logic of organization, the fact that perfectly ordinary people embody the apparently innocuous ends of growth and integration.

On the face of it, this task — which may be represented in this way

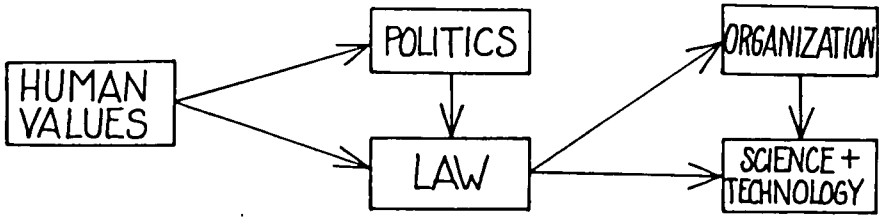

Figure 4

— is neither strange nor overwhelming. The role of law and politics has always been to "get out in front" of organization in order to direct and delimit it. The difficulty is that while Figure 4 is familiar, it is not descriptive — it is not, in the minds of many, at all an accurate picture of the way that science and technology policy decisions are made. In substantial measure, law and politics have been subsumed by administration.[11] The bureaucracy is itself the source of law and its hearings the forum of politics. Legislative edict and judicial review exercise only the weakest of controls. Legislators are important not as a source of law but as a lobby group with administrative agencies. Judges are able to detect only the most egregious violations of procedural due process.

Any number of proposals have been suggested for reestablishing the predominance of human values over organization. We will take them up at some length in Part IV, but several should be mentioned here. One suggestion[12] calls for a new Constitution, geared to the age of administration. It would define an entirely new set of rights tailored to the age of modern science, such as the right to natural reproduction, the right to control the content of information about oneself in electronic storage, the right to compete for jobs without having to take objective examinations, and so on.

Another proposal would achieve the same objective without the need for constitutional change. It would have the Supreme Court assertively utilize the Ninth Amendment[13] to develop new rights to assure individual liberty and autonomy in the technological age.

Both of these proposals would have the effect of reviving parametric values and inserting them far more deeply into the administrative process. And they would do it without higher levels of organization. Rights are asserted by the individuals who are effected by a decision, not by an administration. A deeper penetration of individual rights into science and technology policy decisions would open them to review outside of the administrative process itself.

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[11] "The modern method of social control involves the application of rationality to all social relations. In production we call it technology. In exchange it is called commerce or markets. In social structure we have here called it differentiation. *Rationality applied to social control is administration.* Administration may indeed be the *sine qua non* of modernity." Theodore Lowi, *supra,* note 7 at 27.

[12] *See, for example,* Harvy Wheeler, *Bringing Science Under Control,* II Center Magazine 59 (March 1969) and Wilbur H. Terry, *Must We Rewrite the Constitution to Control Technology,* Sat. Rev. 50 (Mar. 2, 1968).

[13] "The enumeration in the Constitution, of certain rights, shall not be construed to deny or disparage others retained by the people."

The difficulty with the parametric approach is that, once a right has been established, it forecloses an entire sector of behavior. If, to take an unlikely example, each person were to have the right to live in an environment with no more than background levels of radiation, every governmental decision that affected the use of nuclear technology would be subject to attack by any citizen. Only those actions which could be undertaken without any outside risk of radiation would be allowed. Development of that technology would be stopped, as would the development of hydroelectric power, the extraction of fossil fuels, and new building construction, all of which concentrate background radiation.

The rights approach to the control of organization is perhaps the most powerful, for it puts power in the hands of each person and vests the decision in judges and juries, which are only loosely bonded to organization. But rights are a very poorly understood control mechanism. If they are to be used as a matter of positive policy and not left to evolve out of hundreds of years of practice, their dynamics must be well understood. At present levels of ignorance this would seem a very dangerous path to take.

Another set of solutions revolves around the political process. One[14] would create an entirely separate science and technology legislature composed of elected representatives. It would be sovereign on every question of policy. Decisions about the funding of scientific research would be taken out of NSF, NIH, and the lot and made by it, as would decisions about the implementation of technology by the Defense Department, DOT, and so on. With all such questions extracted from the bowels of organization and put in the hands of highly visible popular representatives, the theory goes, the bond between science, technology and organization would be broken. Further advance would proceed without the organizational thumb on the scale. Such things as genetic engineering and nuclear power might be stopped dead in their tracks.

The science government idea has several advantages over the science rights approach. First, it would drive science and technology directly, not leave that to the interstices between rights. Second, it would be more flexible, allowing for tentative experimentation into areas that a rights approach would foreclose. Third, it would heighten public awareness of and information about the direction of future change.

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[14] Harvey Wheeler, *supra*, note 12.

But the science government would itself be a massive centralized organization. Paradigm 3 would suggest that before it had been in operation for a month it would be bathed in the administrative agencies and their clients. There is little reason to believe that it would be driven by public opinion rather than the curious version of the public interest that resides within large scale organization.

An irony of paradigm 4 is that we look for an organized solution to the problem of organization. There appear to be only two fruitful solutions to the dangers of paradigm 3. One is disorganization. A radical decline in food or energy output per capita might destroy the surplus energy needed for high levels of organization (though that would surely increase the desirability of it). A more controlled form of disorganization is suggested above in the definition of new rights. By placing greater legal power in the hands of citizens individual aims are injected into the calculus of the public interest.

The other solution exists within science and technology itself: the evolution of technologies of small scale. To this point, technology has almost entirely favored the large scale centralization of power.[15] By creating economies of scale, by making specialization of labor ever more profitable, by improving record keeping, and in hundreds of other ways, technology has been the story of the centralization of power. But it may not be necessarily so. There is some indication that, at a high enough level of technology, decentralization may be favored. The development of localized solar power, of highly efficient home food growing techniques, of cable television, and of microcomputers raises the possibility that the era of high centralization is transitory, that technology is, after all, human in scale.

And that raises the possibility that paradigm 4 is entirely foolish, that an attempt to use law to direct technology may be counterproductive of human values. But even then we are left with the need to unhinge science and technology from organization. For, unless we are convinced that organizational ends exert no power over science and technology, we must somehow assure that they are not directed to ends not our own. There is some indication that when confronted with a choice between a centralizing and a decentralizing technology, an organization will always choose the former. This has been used to explain why nuclear power has received such overwhelming support by industry and government in the face of solar, wind, and other localized sources of power. It is at this sort of difficulty that paradigm 4 is directed.

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[15] *See* Spreng and Weinberg, *supra,* note 4.

Paradigm 4 places a burden upon law very different from the burden of the first three paradigms. It calls upon law for rights and statutes that would control organization itself. Virtually nothing is known about how that would be done or, in fact, about how laws work or how effective they are. The massive outpouring of laws evinces a great faith in them, but that faith may be misguided. It may be, for instance, that a law of entropy applies to law, so that the more there are, the weaker they are as their signals cross and confuse controls. The shift from adjudication to administration may simply be an effort to correct for incoherence in laws. But we don't know that. Science has shown very little interest, until recently, in the way law works. And lawyers have shown almost none.

The law/scientist faces a formidable task under paradigm 4. He must generate a theory *about* law,[16] a descriptive theory of the way that law functions in society. To this point, no law school has shown any stomach for the enormous descriptive job to be done and few universities have shown a taste for the normative jungles of law. Any number of people are willing to voice an opinion about whether or not genetic engineering is a good idea. But none suggest how a *society* might go about answering that question. Should its use be left to the medical profession? decided by referrendum? handled by Congress and a blue ribbon council? It is one thing to make social policy. Quite another to deliver it effectively through law.

5. Law is Itself a Form of Technology.

To this point we have been concerned with law as a normative system, a system for translating values into the control of behavior. Now we will ignore values and focus upon the function of law as a controller of behavior. In this light, law is a form of technology — one of the many ways that human behavior is altered by the application of technique.

Technology is the process of modifying the relationship between people and things to produce more efficiently that which is desired. Hard technology changes behavior by interposing between the person and the object a tool which facilitates the result, as when a person who is working away at a nut with his bare hands is given a wrench. Soft technology — "know how" — interposes an idea or an understanding between the person and the object, as when one learns to

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[16] Harold Lasswell and Myres McDougal discuss the difference between a theory *of* law and a theory *about* law in *Criteria for a Theory About Law,* 44 So. Cal. L. Rev. 361 (1971).

talk. Law is that special branch of technology that emerges when the object to be manipulated objects to the manipulation.

One need not gain the acquiescence of a car if one desires to drive it. One must see to its *needs,* that it has gasoline and so on. But one need not see to its *will,* for it has no purpose of its own which is inconsistent with being driven. When one wishes to have another *person* drive the car, however, the problem is more complicated. The other person does have a will, does have desires to fulfill other than driving the car. There are many ways of dealing with this difficulty. One is simply to overwhelm the other, forcing him at gunpoint, perhaps, to drive. Or one could wrap the person in administration, drafting him into the Army and giving him the job of driving cars. Or one could take the contract law approach, requiring that a person acquiesce before his behavior is controlled by another.

Whatever approach is taken, it is clear that it is necessitated by the fact that humans have will (or ego, or egotism, call it what you will), while other objects of manipulation do not. But too much should not be made of this distinction, for it is also clear that humans are also directly manipulated by technology without the intervention of law. When a technological development, such as the advent of television, is perceived by people not as a manipulation of their will but as an augmentation of it (so that, with television, they have easier access to entertainment), law is not interposed as a controller. There is no need for coercion, beyond FCC control of scarce airways and contract law governing the transfer of TV sets.

This fact, that technology can be devised for modifying human behavior without the interposition of law (coercion), creates the possibility of eliminating much law by the development of a "technology of behavior" — to use B.F. Skinner's term.[17] An example: At present we guard against drunken drivers by law — threats of prosecution, police surveillance, and so on. There is another way of doing it. If science devised an auto ignition system that would not fire if the driver had been drinking, perhaps by monitoring the alcohol content of his breath, we could substitute this system for law. Similarly, air bags may be a more effective way of protecting against auto injuries than traffic and tort laws. And genetic and behavioral engineering may be a better protection against criminal behavior than the criminal justice system.

What we call law may, in fact, be only a crude first approximation of an effective system of behavioral control. An analogy: When pe-

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[17] B.F. Skinner, *Beyond Freedom and Dignity,* New York, Alfred A. Knopf, Inc., 1971.

troleum was first refined it was cracked by enormous forces of heat and pressure. As the chemistry of oil became understood, it was possible to crack petroleum far more efficiently, by means of catalysts, using less heat and pressure. Law may be the brute force approach to behavior control, yielding to technological approaches that manipulate behavior without being coercive. The great cost of law, and its limited effectiveness, create a demand for technological substitutes — for breathalyzers and conclusive presumptions of guilt instead of lengthy trials; for lie detectors instead of police investigations; for automatic systems of pollution control rather than investigation and hearings.

This relationship between law, science and technology can be visualized in this way:

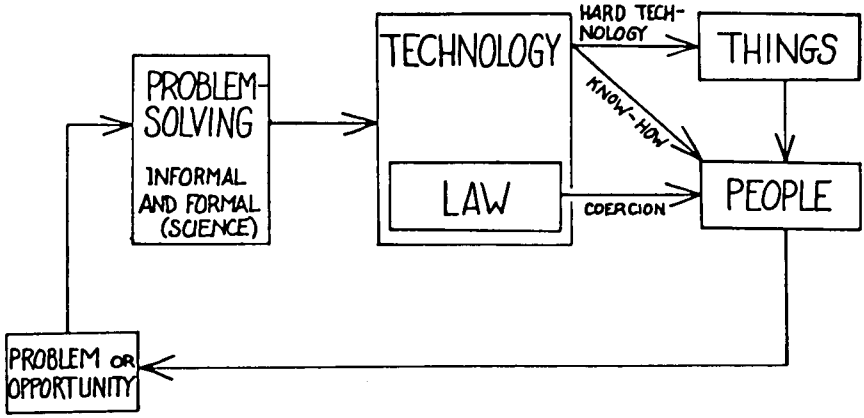

Figure 5

In this model, some aspect of human behavior creates a problem or an unfilled desire creates an opportunity — let us say for example the increase in automobile accidents that attended the introduction of the car. This triggers problem-solving, both within the formal strictures of science (increasingly so) and informally in backyards, garages and courts of law. The solutions are technology. It may be in the form of hard technology (e.g., improved braking systems, better highway design, air bags, etc.), in which case human behavior will be modified automatically as humans interact with safer cars and roads. Or it may take the form of soft technology, such as driver education programs, propaganda campaigns, rules of personal liability for injuries, traffic law, and so on.

Each form of technology is in competition with the others. So air bags are, at this writing, in a tussle with other forms of passive restraint. Just so, automobile liability laws are in a tussle with no-fault compensation plans. *The* test of a technology is its efficiency. If no fault plans reduce compensation costs, but only at the cost of a substantial increase in the accident rate, they will fail in competition with liability plans. Their costs will have exceeded their benefits. In paradigm 5, justice is efficiency.

Laws compete not only against other laws but also against other forms of technology. Law may be competed away altogether. The example that comes to mind is divorce, where advances in psychological counseling and the demonstration by science of the ill-effects of a bad marriage have reduced divorce law to little more than a formalism. In some states, a counseling approach has been entirely substituted for a legal approach. The law has no "right" to the problems that it solved. If they can be solved in other ways, law will be competed out of the picture.

As it probes more deeply into human behavior, science creates ever more powerful alternatives to law. One particularly promising area of technology involves the modification of brain function by implanting electrodes in the sectors that control violent behavior. Stimulation of the electrodes by radio waves may offer a far more effective wway of eliminating criminal behavior than imprisonment. Psychosurgery and chemical modification of the nervous system offer similar promise.

If justice is efficiency, scientific advance may eliminate law altogether. If rights are simply a way of delivering upon an objective (e.g., fewer traffic accidents, lower crime rate), they will yield to more effective control systems. The role of the law/scientist here is to facilitate the utilization of the new technologies through innovation in law. He is a specialist in the new field of the technology of behavior, taking his seat with the designer of behavior modification programs, the psychosurgeon and the economist to design institutions that more effectively control human behavior toward specific objectives.

If there is more to justice than the efficient production of social ends, the substitution of other forms of technology for law may be a dangerous process. But there is little beyond sentiment and the bankrupt notion of natural rights to suggest that there is more to it. Sentiment will not stand for long in the face of a demonstration that psychosurgery or drug therapy can eliminate the crime problem.

The problem here, if there is a problem, is that science has solved the easy problems first. Before it could tackle such questions as

"What is love?" or "What is justice?" it had to ask "What is a neuron?" and "What is a synapse?" Its answers to those questions have generated powerful technologies, so that long before the larger questions are addressed the world is modified by the answers to the easy ones. The difficulty is that our enthusiasm with manipulation may prevent us from getting to the larger questions. Who needs to know precisely what it is about crime that is bad, when the whole business can be eliminated? It does not help that lawyers have been allergic to the bigger questions.

6. Science and Law are Different Manifestations of the Same Thing.

A sixth theme keeps popping up in the law/science literature: There is no basic conflict between law and science (technology is conspicuously left out of this); they are really the same thing.[18] No author, unfortunately, gives a hint of what the "thing" might be. The following is a speculation into the nature of that "thing."

The obvious place to start is with the observation that both science and law deal with laws. We meet immediately, however, a distinction that sets those laws into two different worlds. Scientific laws are said to be descriptive. They are statements that describe *observed* regularities in phenomena. Legal laws are normative. They are statements of a *desired* regularity in human behavior.

A scientific law is judged against *observations*. If its statements do not conform to observations, it is not correct. If the predictions that follow from it are not borne out, it is wrong. And if no predictions follow from it, it is useless.

Legal laws are judged against *desires*. The law that says that thou shalt not murder is right because it is an accurate statement of the way we want things to be, not because it is an accurate statement of the way they are. If there is a difference between the statement of the law and reality (as is the case with murder), we can say that the law and its enforcement are ineffective, but not that it is wrong.

In a sense, legal laws exist because we don't care for the reality that is described by scientific laws. Some of that reality is intractable (e.g., the need of humans to breath air), some is not (e.g., the ten-

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[18] *See* Lawrence Cranberg, *Law – Scientific and Juridicial,* Amer. Sci. 244 (Fall 1968); Dennis Livingston, *An International Law of Science,* 24 Bulletin of the Atomic Scientists 6 (Dec. 1968); Lee Loevinger, *Law and Science as Rival Systems,* 8 Jurimetrics Jour. 63 (1967); A. Hunter Dupree, *Central Scientific Organization in the United States Government,* I Minerva 453 (Summer 1963).

dency of humans to foul the air). The law singles out those parts of reality which are unpleasant but not intractable (and which are not more effectively dealt with by other forms of technology, under paradigm 5), and it directs coercion at them.

It occasionally picks out intractable realities (e.g. Prohibition) and spins its wheels. There is a natural alliance between science and law here, for science can identify that which coercion cannot change and it can describe the way to use coercion most effectively to produce change. But an alliance between law and science is not what we're after in this paradigm. We're after something deeper.

The distinction between descriptive and normative laws — the distinction between science and law — is not as clear as it seems. First, it may be that all scientific descriptions are, at their root, based upon human desires, just as legal laws are. According to Gödel's theorem,[19] every logical system is based upon axioms or assumptions which cannot be proved within it. In mathematics, for example, we abide by the rule that one is not allowed to divide by zero. Mathematics provides no reason why that is so. Zero is a number. It is legitimate to divide any number by any other number. Except zero. This exclusion is not trivial, for if division by zero were allowed it would be possible to *prove* in a few short steps that any number equals any other number. That would rob mathematics of its effectiveness, so we agree not to do it.

Similar black holes exist in every logical system. They mean that we can never prove anything. Anyone who refuses to agree to the axioms underlying a system can demonstrate that its statements are bogus. We do agree to them because it is useful to do so, just as we agree to respect each other's property rights. Life comes out better in both cases if we agree. But that makes science a gigantic social contract, a means of communication between people, not a source of truth. Scientific laws are descriptive only because we agree to describe things this way. Science is based upon norms.

If science is based upon norms, it is still not normative in the sense that law is: It is immune to normative exhortation, which is the stuff of legal laws. No scientist will get far arguing that the law of gravity should go away, unless he can propose an alternative that is more useful. A judge, on the other hand, can make a law go away for no

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[19] As that theorem is described by Douglas Hofstadter in *Gödel, Escher, Bach,* New York, Basic Books, Inc., Publishers, 1979.

better reason than that he thinks it should (it violates, he might say, some penumbra of the First Amendment). But perhaps that is overstating the normative nature of law. No judge can kill a law for good. It will reappear; it will be pressed in different forms, if others want it.

There is something about a good legal law that makes it durable and effective, as if it described a pattern of human behavior that works or somehow fits with human nature. One is reminded of the idea of natural law, that rights — normative statements that direct coercion — inhere in human nature, that what we perceive to be values or norms or desires are simply the outward manifestations of our willful nature. A good law is not one that is, on the plane of ideas, the loftiest, but one that is, on the plane of human nature, the most effective description of human behavior in a given environment.

There was a time when all laws were thought to be normative. Every regularity was explained in terms of will, so the sun rose in the morning because a god dragged it across the heavens. Mankind was dependent upon the will of the gods. But that yielded to observation. It became possible to explain the movement of the sun without reference to an intervening will. Occam's razor trimmed the gods out of the picture.

That left us with the division between descriptive and normative laws. Could it be that no regularity is normative? That the law is a process of slowly describing something? Could it be that legal laws are what you get when you try to describe will? Law, in this sense, would be a continuing attempt to describe how fully human beings can live together in an environment that is constantly changing. It would be an effort to describe that which does not exist: a world in which the will of each person is maximally developed. The domination of the weak by the powerful using positive law and the domination of the environment by people using technology would be seen as transitory phenomena, yielding eventually to a world within which will finally learned to live with the rest of nature and with itself.[20]

It is not clear that speculation of this sort is productive. But, if it may be, lawyers and scientists have a great deal more to learn from each other than is suggested by the first five paradigms. As a start, we might ask each other why some legal laws survive while others

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[20] This theme is suggested, though without mention of law, by Teilhard de Chardin, *The Phenomenon of Man,* trans. by Bernard Wall, New York, Harper & Row, Publishers, Inc. 1959.

die and why some scientific laws survive while others die. It may be the same reason, in which case we have something serious to talk about.

CURRENT LITERATURE IN LAW/SCIENCE: POLICY AND INTELLECTUAL AND INDUSTRIAL PROPERTY

COMPILED BY THOMAS M. STEELE*
AND JUDITH GIRE NORCROSS**

With the pages that follow this introduction, IDEA continues publication of a current listing of materials in the areas of the law/science interface. This listing concentrates on materials dealing with intellectual and industrial property and science policy. While every effort is made to furnish complete order information, readers should feel free to contact the compilers for more information. The compilers encourage readers to bring materials of merit, published and unpublished, to their attention.

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COMMENTARY

More on "New Matter"

A recent opinion of the Court of Customs and Patent Appeals (C.C.P.A.) bolsters the "term-of-art" status of "new matter" insofar as terminology introduced in a continuation-in-part (cip) application is required to support a claimed invention. According to the noted opinion [*In re Lange,* 209 U.S.P.Q. 288, 292 (C.C.P.A. 1981)], the United States Patent and Trademark Office (PTO) Board of Appeals (Board) had affirmed a rejection of all claims under 35 U.S.C. 103 on Appellant's own German application (published December 19, 1968) in view of his British patent (published September 16, 1970). Notwithstanding Appellant's arguments, the Board found that these references were prior art to Appellant because he was not entitled to rely on the filing date (April 8, 1968) of his parent application or that (January 18, 1965) of his grandparent application for priority under 35 U.S.C. 120; disclosures of the earlier-filed applications were not considered sufficient to support the present claims under 35 U.S.C. 112, paragraph 1, for two reasons: First, the grandparent's specification disclosed the combination of metallic *elements,* such as tungsten and molybdenum, and nonmetallic *elements,* such as fluorine, sulphur and selenium, instead of metallic and nonmetallic compounds or substances incorporating those elements (Appellant's failure to disclose how those *elements* might be combined to form the electrodes was regarded as a deficiency in disclosing how to practice the invention); and second, the claim limitation that the gas have "an ultimate dielectric strength of an order of magnitude greater than that of air" is not found in the earlier disclosure. As the subject application was filed more than one year after the publication of both the German application and the British patent, both were viable references unless Appellant could reply upon his grandparent or his parent application. The instant application was a continuation in part (cip) of the parent application which, in turn, was a continuation of the grandparent application.

Appellant argued that the grandparent application was enabling when considered in light of prior-art references recognized by both Appellant and the PTO to be indicative of the level of ordinary skill in the art and in light of well-known inherent properties of gases specified in the grandparent application. Consequently, Appellant main-

tained that the claims are entitled to the filing date of the grandparent and parent applications and that the PTO was precluded from applying Appellant's British patent and German application as references.

The C.C.P.A. agreed with the Board that Appellant's grandparent application had not expressly disclosed how the nonmetallic *elements,* fluorine, sulphur or selenium, could be combined with the metallic *elements,* tungsten or molybdenum, to form electrodes of the required type, but recognized that the disclosure in question must be read in the light of knowledge possessed by those skilled in the art. That knowledge can be established by affidavits of fact composed by an expert (*In re Katzschmann,* 146 U.S.P.Q. 66, C.C.P.A. 1965) and by reference to patents and publications available to the public prior to Appellant's filing date (*In re Eynde,* 178 U.S.P.Q. 470, C.C.P.A. 1973). An affidavit (provided by Appellant during prosecution) of an expert combined with clear teachings of references of record satisfied the C.C.P.A.; the gap relied upon by the Board was thus regarded as adequately filled for one of ordinary skill in the art.

Even though the claim limitation "said arc quenching gas having an ultimate dielectric strength of an order of magnitude greater than that of air" is not expressly disclosed in the grandparent application, two of the references confirm that this is a well-known, inherent property of one of the gases disclosed in the grandparent application. As stated in *In re Smythe,* 178 U.S.P.Q. 279, 285 (C.C.P.A. 1973):

> By disclosing in a parent application a device that inherently performs a function, operated according to a theory, or has [an] advantage, a patent application necessarily discloses that function, theory or advantage even though he [it] says nothing concerning it. The application may later be amended to recite the function, theory or advantage without introducing prohibited new matter.

The holding in this case raises several interesting points. One of these concerns the definition of a cip. When the sole difference between an earlier- and later-filed copending application is the inclusion in the latter of one or more properties that are relied upon for patentability, it appears that the subsequently-filed application can be regarded as a continuation application in view of the fact that the properties are inherently disclosed in the parent application. What is even more significant, however, is the apparent approval of amending the parent application to include a previously-undisclosed property to be relied upon to establish patentability over applied art. Authorization for such amendments would obviate refiling many applications and would undoubtedly lead to the entry (after an office action is made final) of numerous amendments that are now refused as raising an issue of "new matter".

Although there may be every reason to believe that a fundamental underlying principle has now been cast in steel, there are those who will still question how far the principal will be followed or stretched. If an application discloses a number of alternative compounds for a particular purpose and one specified compound has peculiar recognized (but undisclosed) properties, does the applicant have a right to amend the application to claim the use of compounds having those properties even though such a class of compounds is not recognized in the application? Notwithstanding reliance on *In re Smythe, supra,* support for the scope of such class of compounds may still be subject to question.

Ramifications of this reported opinion of the C.C.P.A. are not necessarily limited to an effective date on which an applicant may rely to overcome applied art. Reliance has also been placed on disclosures of parent and grandparent applications (carried over into issued patents) as prior art under 35 U.S.C. 102(e) and/or 35 U.S.C. 103. A most interesting and enlightening opinion in this regard is provided by *In re Wertheim,* 209 U.S.P.Q. 554 (C.C.P.A. 1981). When a parent application of a patent (based on a cip) is relied upon as prior art to preclude patentability, we are told that such is possible only when the parent application constitutes a constructive reduction to practice of at least one claim in the issued patent. The rationale of the C.C.P.A. appears in the following text:

> We emphasize that the above noted statutes, §§102(e), 120, and 112, speak with reference to some specific claimed subject matter by use of the terms emphasized. It is axiomatic in patent law that questions of description, disclosure, enablement, anticipation, and obviousness can only be discussed with reference to a specific claim which identifies "the invention" referred to in the statutes.
>
> Thus, the determinative question here is whether the invention claimed in the Pfluger patent finds a *supporting disclosure in compliance* with §112, as required by §120, in the 1961 Pfluger I application so as to entitle that invention in the Pfluger patent, as "prior art," to the filing date of Pfluger I. Without such support, the invention, and its accompanying disclosure, cannot be regarded as prior art as of that filing date.
>
> As previously noted, new matter can add material limitations which transform an unpatentable invention, when viewed as a whole against the prior art, into a patentable one. A continuation-in-part application, unlike a continuation application, does not necessarily insure that all critical

aspects of the later disclosure were present in the parent. Thus, in a situation such as this, only an application disclosing the patentable invention before the addition of new matter, which disclosure is carried over into the patent, can be relied upon to give a reference disclosure the benefit of its filing date for the purpose of supporting a §§102(e)/103 rejection.

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The Board erred in ruling that since "the substance of the relevant disclosure in Pfluger I was carried forward into the patent," that same disclosure in the reference patent was entitled to the Pfluger I filing date, *even though the entire patent was not.* While some of the reference patent disclosure can be traced to Pfluger I, such portions of the original disclosure cannot be found "carried over" for the purpose of awarding filing dates, unless that disclosure constituted a full, clear, concise and exact description in accordance with §112, first paragraph, of the invention claimed in the reference patent, else the application could not have matured into a patent, within the Milburn §102(e) rationale, to be "prior art" under §103.

The two claim limitations of the reference patent missing from Pfluger I were a necessary part of the only patentable invention ever set forth in the Pfluger file history. These limitations, however, were neither expressly nor inherently part of the original Pfluger disclosure. Absent these steps, the Pfluger filing date cannot be accorded to the Pfluger patent reference. Without that date, the reference does not antedate Wertheim's alleged actual reduction to practice and cannot be combined with another reference to support a §103 rejection.

To look at it another way, without the benefit of the Pfluger I filing date, that part of the reference patent disclosure relied upon cannot be said to have been incipient public knowledge as of that date "but for" the delays of the Patent and Trademark Office, under the Millburn rationale. Here, it cannot be said to have been "carried over" into the reference patent for purposes of defeating another's application for a patent under §§102(e)/103.

The *Milburn* case referred to is *The Alexander Milburn Company vs. Davis-Bournonville Company,* 270 U.S. 390 (U.S.S.Ct. 1926), in which

the validity of Whitford's patent was placed in issue in an infringement suit. The defense maintained that Whitford was not the first inventor of the patented invention since that which was claimed in Whitford's patent was fully disclosed in Clifford's patent. Although Clifford's patent issued after Whitford's, it was based on an application filed prior to that of Whitford, and Whitford could not establish a date prior to that of Clifford's filing date. Although Clifford disclosed this invention, such invention was not claimed in Clifford's patent. The opinion of the United States Supreme Court states:

> . . . The delays of the patent office ought not to cut down the effect of what has been done. The description shows that Whitford was not the first inventor. Clifford had done all that he could to make his description public. He had taken steps that would make it public as soon as the Patent Office did its work, although, of course, amendments might be required of him before the end could be reached. We see no reason in the words or policy of the law for allowing Whitford to profit by the delay and make himself out to be the first inventor when he was not so in fact, when Clifford had shown knowledge inconsistent with the allowance of Whitford's claim . . .
>
> The question is not whether Clifford showed himself by the description to be first inventor. . . .The question is whether Clifford's disclosure made it impossible for Whitford to claim the invention at a later date. . . .It is not necessary to show who did invent the thing in order to show that Whitford did not.

In the *Wertheim* case the C.C.P.A. was dealing with the substance of a claimed invention. If Pfluger had disclosed another invention beyond that which was claimed (as in the *Milburn* case) and the other invention was completely described in Pfluger I, Pfluger II and Pfluger III, the rationale of the C.C.P.A. would lead one to believe that such disclosure would not preclude the patentability to Wertheim of such other invention merely because Pfluger I did not adequately support the invention claimed in Pfluger III.

Clearly such issue was not before the C.C.P.A. in the *Wertheim* case. Under the rationale of the *Milburn* doctrine, however, the noted hypothetical facts appear to negate first inventorship in another who cannot antedate the earliest date of disclosure of an invention in a series of copending applications which eventually mature into a patent and wherein each application in turn completely described the invention relied upon.

Another wrinkle in the same general context is presented when a parent application fails to disclose a property which must be relied upon to overcome prior art applied under 35 U.S.C. 103. If a continuing application has to be filed to specify such property as a basis for evidence of unexpected results, the parent application (without such property disclosed) could not have issued as a patent "but for" delays of the PTO. It will be interesting to see whether the parent application

will be available as prior art (as of its filing date) under these circumstances after a patent issues on the continuing application. The Wertheim decision has a potential for seeking clarification with regard to many variations on this same theme.

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BOOK REVIEW

PATENT LAW FUNDAMENTALS (Second Ed. 1980) by Peter D. Rosenberg
Published by Clark Boardman, Ltd.

The second edition of this work, although based on the format and approach of the original work, is expanded considerably as to subject matter and has been updated in view of recent court decisions and developments.

This edition has added a section which compares and contrasts the concepts and rights pertaining to patents, trade secrets, trademarks and copyrights. A full chapter on trademarks has been added, as well as a chapter on copyrights and a chapter on trade secrets. These new chapters are quite extensive for inclusion in a treatise that is designed for the layman, as well as the general practitioner of law.

The chapter on "Priority of Invention" has been expanded. This area of patent law, sometimes called the "metaphysics" of law, is difficult to understand not only by laymen, but also by many attorneys and judges. The author has done well in his treatment of this concept; one which is unique to the United States patent system.

The chapter on transnational patent law has been expanded considerably, with material and charts explaining the operation and impact of the Patent Cooperation Treaty, and a brief explanation of the European Patent Convention. The problems arising from the importation and exportation of patented items are discussed in sufficient detail.

The expanded section on comparative patent law will be of assistance to those persons having the responsibility for U.S. firms of protecting inventions in foreign countries.

An example of the updating of the second edition of this work is the portion on Prosecuting Applications dealing with the new procedure and policy concerning reissue patents.

The author's continuing efforts to provide a treatise on intellectual

property law which is readily understood by the layman as well as the attorney versed in this field are commendable. This goal has been reached in most of the chapters, but not in other highly technical areas, as for example, priority of invention. This treatise would be an excellent choice as a text book for use in undergraduate as well as graduate courses for engineers and scientists, as well as law school courses in intellectual property.

The second edition has been issued in looseleaf form to facilitate updating of the text. No information has been given as to the frequency at which changes will be made in the text. The index and table of cases are complete. The placing of footnotes at the bottom of each page, rather than at the end of each chapter as in the first edition, improves the readability of this work.

Reviewed by Harry M. Saragovitz

Proposed Amendments to the FRCP

The readers of IDEA might be interested to learn that the Judicial Conference Advisory Committee on the Federal Rules of Civil Procedure has proposed amendments to Rules 6, 7, 11, 16, 26, 52, 53 and 67. It has also proposed new Rules 72 through 76.

The Judicial Conference Standing Committee has not yet considered these proposed amendments, but submits them for comment from the bench and bar.

The proposed amendment to Rule 6 would make explicit that attorneys, and unrepresented parties, must sign motions and other papers. This signing would certify that the attorney or party had read the motion and had a reasonable belief that there was good ground to support it, and that the motion was not filed for some improper purpose. For violation of this rule sanctions may be imposed. These sanctions include, but are not limited to, imposition of costs and attorney's fees.

Rule 6 (b) (3) explicitly authorizes what district court judges had been doing through a combined reading of Rules 6 and 11. Because of a reluctance on the part of some judges to impose sanctions, an amendment to Rule 6 was thought necessary.

The Advisory Committee's proposal to amend Rule 11 is simply to bring its language into conformity with the new language of Rule 6 (b) (3).

Of significance to Patent Attorneys and others concerned with the protection of intellectual and industrial property are the proposed amendments to Rules 16 and 26.

Rule 16 concerns pretrial conferences and a recognition of greater judicial management. Subsection (a), while more detailed, remains essentially unchanged. Subsection (b) requires the judge to enter a scheduling order regarding joinder and amending pleadings, service and hearing of motions, and the completion of discovery. This subsection requires that such order issue as soon as practicable "but in no event more than 90 days after filing of the complaint."

Subsection (c) of Rule 16 details those subjects to be dealt with at the pretrial conference. The formulation and simplification of issues, obtaining admissions of fact and the possibility of settlement are but several mentioned in the proposed amendment.

Of particular concern to Patent and Anti-trust attorneys might be subsection (c) (10) which provides:

> the need for adopting special procedures for managing potentially difficult or protracted actions that may involve complex issues, multiple parties, difficult legal questions, or unusual proof problems . . .

Rule 16, like rule 6, has a provision for sanctioning attorneys or parties who violate a scheduling or pretrial order. It is not known how much, if any, the proposed amendment will change current practice by judges in their management of complex litigation.

Rule 26 concerns general provisions governing discovery. Subdivision (a) and the first paragraph of subdivision (b) remain virtually unchanged, permitting liberal discovery in federal courts. It is with the last paragraph of subdivision (b) that the proposed amendment gives judges the power to limit discovery. If it is found that the discovery sought is duplicative, unreasonably cumulative, obtainable from a source less burdensome or more convenient, is unduly expensive and the like, a protective order may be issued.

Again Rule 26 (g) requires that an attorney sign discovery papers as a form of certification found in Rules 6 and 11. Finally, Rule 26 (g) provides sanctions for violation of the Rule.

Rules 52 through 67 might be regarded as housekeeping rules. Rules 72 through 76 are concerned with bringing the rules up to date with the expanded functions of United States Magistrates.

All views concerning these proposed amendments should be sent to the Committee on Rules of Practice and Procedure, Administrative Office of the United States Courts, Washington, D.C. 20544 no later than November 16, 1981.

Public hearings will be held at the Court of Claims Building in

Washington, D.C. on October 16, 1981 and at the United States Courthouse in Los Angeles, California on November 16, 1981.

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PTC Research Report CONCEPTS AND THEORIES IN DETERMINING A "REASONABLE AND ENTIRE COMPENSATION" UNDER 28 USC 1498

BY HARRY M. SARAGOVITZ*

The U.S. Government first waived its sovereign immunity to suit for patent infringement in 1910.[1] This statute however, did not establish the U.S. Court of Claims as having *exclusive* jurisdiction of patent infringement suits arising out of manufacture and use *by or for* the government. It was still possible for the patent owner to sue the manufacturer in the U.S. District Courts and obtain an injunction as well as damages against the manufacturer. This avenue of redress against the infringing supplier of items for the Government was closed in 1918,[2] which now appears with some changes as 28 U.S.C. 1498. This established the U.S. Court of Claims as the *exclusive* forum for suits to recover for infringing manufacture and use by or for

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[1] 36 Stat. 851, Chapter 423. States in part,
"That whenever an invention described in and covered by a patent of the United States shall hereafter be used by the United States without license of the owner thereof or lawful right to use the same, such owner *may* recover reasonable compensation for such use by suit in the Court of Claims . . . ." (Emphasis added.)

[2] 40 Stat. 705, States in part,
"That whenever an invention described in and covered by a patent of the United States shall hereafter be used or manufactured by or for the United States without license of the owner thereof or lawful right to use or manufacture the same, the owner's remedy *shall* be by suit against the United States in the Court of Claims for the recovery of his reasonable and *entire* compensation for such use and manufacture . . . ." (Emphasis added.)

the Government. The present law[3] states in part that suit can be brought to recover "reasonable and entire compensation" for unauthorized use of plaintiff's patent arising from manufacture and use by or for the Government.

The Court of Claims has since struggled with the problem of what constitutes a "reasonable and entire compensation" for such infringing use. A number of articles have been written regarding the probability of success in bringing suit against the Government for patent infringement. Statistics have been cited as to the amounts recovered by successful plaintiffs in such patent infringement suits.[4] Since each case is different, various theories and concepts are often used by the Court of Claims to determine the "reasonable and entire compensation" required by 28 U.S.C. §1498 after liability has been established. This article is intended to give an overview of some of the theories and concepts utilized by the Court of Claims in reaching decisions on what constitutes a "reasonable and entire compensation" in some of these suits.

Very early in the history of this waiver of sovereign immunity, the Court of Claims held that the unauthorized use of a patent by the U.S. Government was considered to be in the nature of a tort.[5] Later, it was held that a suit for such unauthorized use should be considered as a suit for compensation for the eminent domain "taking" of a patent license.[6] Since that decision, the eminent domain theory has been followed consistently by the Court of Claims.[7] Thus, some of the remedies available to a patent owner by suit under 28 U.S.C. §§284, 285 are not available under 28 U.S.C. §1498. For example, the successful plaintiff under 28 U.S.C. 1498 cannot obtain an injunction, punitive damages, or attorney's fees. This was emphasized in the case of *Leesona Corp. v. U.S.*, in which the Trial Judge awarded not only increased damages, but also attorney's fees because of strong evidence that the Government had acted in bad faith.[8] The full Court of Claims reversed the Trial Judge and held that "reasonable and entire compensation" for an eminent domain taking cannot turn the case into a

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[3] 28 U.S.C. §1498.

[4] See APLA Bulletin July-August 1979, Symposium on Court of Claims Practice.

[5] *Waite v. U.S.* 69 Ct. Cls. 153 (1930).

[6] *Crozier v. Krupp*, 224 U.S. 290, 305 (1912); *Olsson v. U.S.* 87 Ct. Cls. 642, 25F. Supp. 495 (1938), cert. denied 307 U.S. 621, reh. denied 367 U.S. 650.

[7] See e.g., *Irving Air Chute Co. v. U.S.* 117 Ct. Cls. 799 (1950), *Tektronics v. U.S.* 213 Ct. Cls. 257, 552 F. 2nd 343 (1977), and *Leesona v. U.S.* 202 U.S.P.Q. 424, Ct. Cls. (1979).

[8] *Leesona v. U.S.* 198 U.S.P.Q. 4 (1978).

tort action even though there was strong evidence that the Government acted in bad faith.[9]

After it was established that recovery for patent infringement by or for the Government was limited to suit against the Government in the U.S. Court of Claims, and that such infringement was tantamount to the eminent domain taking of a patent license, the Court of Claims began to develop various theories and concepts to determine a "reasonable and entire compensation" based upon the facts in each case.

If it is feasible, the Court utilizes a reasonable royalty as the measure of "reasonable and entire compensation." A reasonably royalty is defined in 69 C.J.S. § 359 as

> an amount which, in view of the nature, utility, and advantages of the invention, and the extent of use involved, the parties would probably have agreed on if [the] plaintiff was willing to grant a license and [the] defendant wished to obtain one, neither party being compelled to do so, and both parties were reasonably endeavoring to reach an agreement.

Added to this is an award for "delayed compensation," (a euphemism for interest) from the time of the "taking" of the license by the U.S., until the date the award is satisfied. Further discussion of "delayed" compensation is set forth later in this article.

Where an established royalty rate for a particular patent exists, that rate can be adopted by the Court of Claims as the "reasonable and entire compensation". However, when no such royalty rate is shown, other methods must be used to establish a measure of "reasonable and entire compensation." In some instances the Court has modified an existing royalty rate if the circumstances warrant such modification, as in *Tektronics v. U.S.*[10] This decision also reviews in detail the eminent domain theory used by the Court of Claims since its inception.[11]

If no established royalty rate can be shown, the Court may look to royalty rates that have been set or accepted for related patents or patents in the same field or art. In at least one case, *Saulnier v. U.S.*,[12] the Court adopted a royalty rate which had been used in a settlement agreement entered into in a previous dispute involving the same pat-

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[9] *Leesona v. U.S.* 202 U.S.P.Q. 424 (1979), 599 F. 2nd 958.

[10] 193 U.S.P.Q. 385, 552 F. 2nd 343, 213 Ct. Cls. 257 (1977). See footnote 5 of that decision.)

[11] See footnote 6, *supra.*

[12] 137 U.S.P.Q. 222, 161 Ct. Cls. 223, 314 F.2d 950 (1963).

ent. In *Barlow v. U.S.*,[13] the Court utilized other contracts between the same parties as a basis for calculating the royalty rate.

In a few of the earlier cases the Court utilized the savings realized by the Government in the use of the patent in suit as a measure of the compensation. See *Olsen v. U.S.*,[14] *and Shearer v. U.S.*,[15] Certiorari was denied in *Olsson* as well as in the *Shearer* case. In some cases the plaintiff urged that lost profits should be a measure of the compensation sought for the unauthorized use. In rare instances, the Court has awarded lost profits as a measure of reasonable compensation. See *Imperial Machine & Foundry Corp. v. U.S.*[16] as one instance. However, in *Tektronics v. U.S.*,[17] the Court denied plaintiff's request that in addition to a royalty rate, lost profits should also be awarded. In denying the request, the Court stated that lost profits should be awarded only after the strictest proofs that profits would actually have been earned by the patentee if it were not for the unauthorized use.

Where there is no established royalty rate to guide the Court, the task becomes more difficult. In some cases of this type the Court has often used the willing seller/willing buyer theory. In utilizing this theory, the Court tries to create an imaginary or hypothetical situation wherein a patentee is willing to sell a license under the patent to an imaginary buyer, for which the buyer is willing to pay an agreed royalty for the license. The theory assumes that neither party is under heavy pressure to contract, and that normal market conditions prevail. The employment of this theory entails the consideration of many factors. For example: Would the licensee become a competitor of the patent owner? Has the patented invention ever been reduced to practice? Has the patent been respected in the industry? Is the invention a small improvement or is it an important or breakthrough invention? Is the patent owner a giant corporation holding a large patent portfolio, or is the owner an individual or small business whose life-blood depends upon one or a very few patents? These and many other factors could conceivably enter into the determination by the Court in utilizing such a theory. Some of these factors may well enter

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[13] 34 U.S.P.Q. 127, 87 Ct. Cls. 287 (1937).

[14] 37 U.S.P.Q. 767, 87 Ct. Cls. 642, 25 F.Supp. 497 (1936), Cert denied 41 U.S.P.Q. 799 (1939).

[15] 101 Ct. Cls. 196, Cert denied 63 U.S.P.Q. 359 (1944).

[16] 5 U.S.P.Q. 332 (1930), 69 Ct. Cl. 667.

[17] See footnote 10, *supra*.

into the Court's consideration even though an established royalty rate is in existence.

In *Tektronics v. U.S.*,[18] the Court lists a number of cases in which it has used the willing seller/willing buyer concept, and also refers to the use of this concept by other courts as well.

In some of the later cases under 28 U.S.C. 1498 the Court held that the royalty rate proposed by the Government's expert witness was far too low and unrealistic. In *Tektronics v. U.S.*,[19] the Trial Judge rejected the "fixed notion" by the Government that royalties should be at a certain level, say 4 to 6 percent. The Judge emphasized that every case should be decided on its own merits. The Court also stated that Tektronics could not be compared in size to corporate giants, and thus could not be compared as to patent portfolio, product line or royalties charged. The Government's expert witness attempted to show that giant corporations with a huge patent portfolio were charging a large number of licensees a low royalty rate, and therefore Tektronics was not entitled to a higher royalty rate. The Court also turned down attempts by the Government to establish unreasonably low royalty rates in *Pitcairn v. U.S.*[20] In that case the Trial Judge held that royalty rates set after Government infringement began were not relevant in setting the Government royalty rate. In *Pitcairn v. U.S.*,[20a] the full Court held that royalty rates set *after* Government infringement began were relevant in setting the Government royalty rate. In *Calhoun v. U.S.*,[21] the Court held that the Government cannot expect to receive the same favorable royalty treatment that was available at an earlier time.

A royalty rate is meaningless unless it is applied to a solid royalty base. The problem arises as to what royalty base is to be used. Even in cases where the eminent domain taking applies to a combination patent, the Government often takes the position that the royalty rate should be applied to only a portion of the combination even though the patent claim covers an entire combination or system which the Government is procuring or using. A problem also arises when necessary spare or replacement parts are procured at the same time the Government procures the entire combination or system. In some cases

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[18] 213 Ct. Cls. 268, 193 U.S.P.Q. 385 (1977). (See footnote 7 of that decision.)

[19] 188 U.S.P.Q. 25 (Sept. 1975).

[20] 188 U.S.P.Q. 35, 547 F.2d 1106.

[20a] 192 U.S.P.Q. 616, 212 Ct. Cl. 168, 547 F.2d 1106 (1976).

[21] 172 U.S.P.Q. 438 (1972), 197 Ct. Cls. 41, 453 F.2d 1385.

of this type, the Court resorts to an approach known as the "entire market rule." This rule is defined in *Decca Ltd. v. U.S.*[22] as

> a judicially fashioned directive that, in certain instances, unpatented items used in combination with a patented invention are to be included in the royalty base for the invention. The directive applies only if the invention has substantially created the value of the items, i.e., the sole utility of the items consists in their being used in combination with the invention.

In *Leesona v. U.S.*,[23] the Court stated that

> Under the entire market value rule, it is not the physical joinder or separation of the contested items that determines their inclusion in or exclusion from the compensation base, as much as their financial and marketing dependence on the patented item under standard marketing procedures for the goods in question.

This rule is explored fully in *Tektronics v. U.S.*,[24] citing the use of the rule in *Marconi Wireless Telegraph v. U.S.*[25] The Court stated in Marconi case that

> ... the invention was of such paramount importance that it substantially created the value of the component parts utilized in the radio transmitters and receivers purchased or acquired by the United States during the accounting period, and that it therefore falls within the entire market value rule. The complete cost of the transmitting and receiving sets should be used as the base in the application of a reasonable royalty.

It is interesting to note that in this case, the Court set a royalty rate of 10 percent and interest at 5 percent, although the Government urged that interest be set at a rate of 2 percent! In *Tektronics*[26] the question arose as to whether the cost of unpatented "plug-in" units was to be included in the computation of the award. In this instance, the Court sided with the plaintiff and held that such plug-in units were subject to the royalty.

In *Leesona v. U.S.*,[27] a similar question arose as to the inclusion of unpatented elements to the patented combination in computing the royalties due to the plaintiff. The Court answered two questions in the affirmative specifically on this point. The first was: Should original equipment unpatented anodes and cathodes be included in the royalty base? (The base was the combination of the entire battery.)

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[22] Deca Ltd. v. U.S. 640 F.2d 1156, 209 U.S.P.Q. 52, Ct. Cls. No. 299-70 (Nov. 1980).

[23] See footnote 9, *supra*.

[24] See footnote 10, *supra*.

[25] 99 Ct. Cls. 46, 53 U.S.P.Q. 246 (1942), modified on other grounds 320 U.S. 1, 57, 57 U.S.P.Q. 471 (1973).

[26] See footnote 10, *supra*.

[27] See footnote 9, *supra*.

The second question was: Should extra anodes and cathodes supplied to the Government at the same time as the entire combination (battery) be included in the royalty base? The Court in this case also applied the "entire market" rule because the Government ordered extra anodes and cathodes with the battery as one procurement practice. Thus, since the advent of the *Marconi* case, the Court of Claims has been more lenient in applying the "entire market" rule to spare parts which have no utilization other than the patented system.

The question of additional payment to the successful plaintiff because of the delay between inception of the suit and payment by the Government of the award, has, for a long time, been a vexing problem for the Court. The necessity for such additional compensation was decided in *Waite v. U.S.*[28] by the U.S. Supreme Court. In that opinion, Justice Holmes stated that the

> "reasonable and entire compensation" [provided by the statute . . .] was intended to accomplish complete justice as between the plaintiff and the United States.

The amount due as delay compensation is determined by multiplying the annual accrued royalties by an appropriate percentage rate. This period covers that time extending from the date of defendent's procurements (taking of a license by eminent domain) until the date of payment of the Court's judgment.

For a long time the Court of Claims utilized a percentage rate for delayed compensation based on the rate of return afforded investors in long-term Government securities, which came usually to 4 percent. However, when commercial interest rates began to rise, plaintiffs began to argue strenuously that the mode of calculating such rates was unrealistic and that the rate should be set in accordance with the commercial rate in existence during the period or periods in question. In *Pitcairn v. U.S.*,[29] the Court held that there was a statutory basis for the use of a commercial rate index in determining the rate of interest to be paid by the Government for delayed compensation. In the case of *Coakwell v. U.S.*,[30] as well as *Alford v. U.S.*,[31] the Court of Claims awarded delayed compensation at the rate of 4 percent. As late as 1972, the Court of Claims in the case of *Amerace Esna Corp. v.*

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[28] 282 U.S. 508, 8 U.S.P.Q. 121 (1931).

[29] 212 Ct. Cls. 168, 192 U.S.P.Q. 612 (Dec. 1976).

[30] 153 U.S.P.Q. 307 (Feb. 1967), 372 F.2d 508.

[31] 151 U.S.P.Q. 416 (Oct. 1966), Ct. Cls. 372 F.2d 508

U.S.[32] awarded delay "damages" at the rate of 4 percent. In *Pitcairn v. U.S.*,[33] the Court adopted the commercial rate in deciding the delayed compensation as follows:

1947-1955	4%
1956-1960	4.5%
1961-1965	4.75%
1966-1970	6.5%
1971-1975	7.5%

In *Leesona v. U.S.*,[34] the Court of Claims awarded compensation for delayed compensation at the rate of 6.5 percent from July 1970 to January 1, 1979, and at the rate of 8 percent from January 1, 1979 to the date of payment of judgment.

In *Tektronics v. U.S.*,[35] petitioner's request that the delayed compensation payment be computed as compound interest was denied as contrary to settled precedent. However, the Court in this instance computed the compensation for delay to conform to the interest rate of AAA corporation bonds and U.S. Treasury securities during the period of liability. In this case, the interest rate rose from 4.6 to 6.59 percent in 1969. In *Pitcairn v. U.S.*,[36] plaintiff requested added compensation due to inflation, which request was refused by the Court. This same decision states that PL 93-625 gives statutory sanction to the use of commercial rate indices to determine the "rate of interest" to be paid by the Government as "delayed compensation."

The recently decided case of *Decca Ltd. v. U.S.*[37] points out again that while 28 U.S.C. 1498 authorized the Government to "take" a license under any U.S. patent by exercising its power of eminent domain, the Government is never "guilty" of infringement insofar as that term denotes the commission of a tort. The Court also held that the Trial Judge erred in using a "cost savings" method to calculate the value of the patent license taken by the Government. Since the patents involved in *Decca* were licensed commercially, the Trial Judge should have used the "reasonable royalty" method of determining the "reasonable and entire compensation" due the petitioner. Decca also argued that it would normally sell its patented system as a

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[32] 199 Ct. Cls. 175, 462 F.2d 1377, 172 U.S.P.Q. 305 (1972), 174 U.S.P.Q. 517.

[33] See footnote 29, *supra*.

[34] See footnote 9, *supra*.

[35] See footnote 10, *supra*.

[36] See footnote 29, *supra*.

[37] See footnote 22, *supra*.

complete working combination, and therefore the royalty base should be the retail price for the entire system. The full Court of Claims, citing its opinion in *Leesona v. U.S.*,[38] held that 28 U.S.C. 1498 does not provide for an award of damages for the loss of business opportunity resulting from the Government's taking of a license.

The Court held that Decca was entitled to compensation calculated on a royalty base starting from the date the Government first used the entire patented combination (direct infringement) until the patent in suit expired, disregarding the profit Decca would have made had it manufactured and sold such systems to the Government. The Court awarded a royalty of 7.5 percent which Decca had previously charged a licensee under a commercial license.

This case establishes the principle that the Government is liable under 28 U.S.C. 1498 only for "direct" infringement, and is not liable for "induced" or contributory infringement. Utilizing the royalty rate of 7.5 percent, and denying the requested royalty base of the retail price of the systems, as well as limiting recovery to "direct" infringement by the Government, the award of $27,245,679 recommended by the Trial Judge was reduced by the full Court to $2,043,425.92 in basic compensation plus delay compensation of $1,131,033.49 through June 30, 1980, plus $445.65 per day until the judgment was satisfied.

In the recent case of *Bendix v. U.S.*,[39] the Court of claims after finding the Government liable for infringement, remanded the case to the Trial Division for a determination of the "reasonable and entire compensation" due petitioner. The Trial Judge observed that the Court of Claims in *Decca v. U.S.*[40] held that where the patent rights taken by the Government are licensed commercially, the "reasonable royalty" method of ascertaining "reasonable and entire compensation" is preferred. The Trial Judge reviewed the various options which ranged from a 15 percent royalty down to a 2 percent royalty, and concluded that while a 10 percent royalty rate would be reasonable as applied to a private infringer, under the constraint of Court of Claims recent decisions, a 7.5 percent would be a reasonable royalty rate. The Trial Judge ruled that Bendix was entitled to delay compensation at the following rates:

1971-1975	7.5%
Jan. 1, 1976-Jan. 30, 1980	8.5%
Feb. 1, 1980-Payment	12%

[38] See footnote 9, *supra.*

[39] 209 U.S.P.Q.778.

[40] See footnote 22, *supra.*

An interesting, and perhaps gratifying action (from petitioner's point of view) was the Trial Judge's award to Bendix of $534 to compensate plaintiff's representatives for expenses in attending a settlement conference at which the Associate Attorney General refused to appear. The Trial Judge labeled this attitude on the part of the Associate Attorney General as a "blatant display of bureaucratic arrogance."

CONCLUSIONS

As seen from this brief overview of the theories and concepts utilized by the Court of Claims in arriving at a "reasonable and entire compensation" for the eminent domain taking of a patent license by the Government, statistical information regarding royalty rates is not very informative or helpful in forecasting the extent of a plaintiff's recovery after infringement has been established. One thing is certain, however, the "delayed compensation" is now more realistic by being based on commercial rates of return rather than being based on the return afforded from long-term Government securities, as was computed formerly. Given the long trial periods to establish liability and the similar long trial periods for the accounting, it is not surprising that in some instances the "delayed compensation" is a greater amount than the liability of the Government for the eminent domain taking of the patent license alone.

THE RELATIONSHIP BETWEEN LAW AND SCIENCE*

BY HUGH GIBBONS**

PART III. Points of Contact Between Law and Science — A Taxonomy

The practice of law is said to be one of the few remaining occupations in which one must be a generalist. That is changing, but there are still many lawyers who are called upon to master the complexities of valuing a work of art on one day and the next day to put together a land-use plan or a touchy labor-management agreement. The explosion of science and technology have made the lawyer's task more demanding and have forced him to specialize. No single person can master medicine well enough to successfully cross-examine doctors in a malpractice case and still have enough left over to handle a patent application, a privacy case against an electronically-based credit firm and an application for a nuclear power plant license. For many lawyers, even the electronic equipment necessary to run an efficient law office is too much to consider.

Science and technology impact upon the law, and upon the practice of law, in increasingly deep and numerous ways. It is the intent of this part of the paper to set those points of contact out in a clear and orderly way. This is sheer morphology — we are concerned here only with the form of the law/science interaction. In a few places I will point out some of the more obvious questions that a particular interaction presents but only in an effort to describe it more fully.

The following classification is based upon a taxonomic scheme proposed by Professor Cavers.[1] He suggested that the relationship be-

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*This is the third part of a four-part article. Part I, *The Law/Science Problem,* was published in IDEA, vol. 22, no. 1, p. 43. Part II, *Six Representations of the Law/Science Relationships,* appeared in IDEA, vol. 23, no. 2, p. 159.

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[1] Cavers, *Introduction: Science and the Law Symposium,* 63 MICH. L. REV. 1325 (1965).

tween law and science consisted of six types of relations: scientific knowledge used to make adjudicatory determinations; scientific knowledge compelling the reexamination of existing legal doctrines; scientific developments creating hazards that require state intervention; governmental inducements for scientific research; tax incentives for technological development; and scientific developments that force new international relationships. That scheme has been altered somewhat in what follows. We have broken the relationship into two major domains (or kingdoms, to use Linnaeus' term): scientific and technological changes that affect the law; and law used by society to affect science and technology. These are the two arms of the process by which law and science affect each other.

I. SCIENCE AND TECHNOLOGY AFFECTING LEGAL INSTITUTIONS

A. The Judicial Process

1. *Science and technology used to make adjudicatory determinations*

- *Adjudication aids.* Technology has provided mechanisms to aid in adjudication since the first court reporter transcribed a trial. Technology presently being incorporated into the judicial process includes videotape equipment, long-distance communications links to eliminate the need for witnesses to be physically present in the court, and, in some places, systems to protect the judge from physical danger.
- *New sources of evidence.* Technology has made it possible to provide objective data where only subjective testimony was once possible. The leading example of this is the polygraph, which has had a difficult time satisfying judicial questions about reliability.[2] More recently, thermography has been used to objectively measure pain by detecting areas of restricted blood flow, making it possible to prove damage in cases that without it look like hypochondria,[3] and new techniques for identifying materials, such as neutron bombardment and electrophoresis, have made it possible to make a positive identification of arsenic in bones, drugs in blood, and so on.[4]

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[2] *See, The Emergence of the Polygraph at Trial,* 73 Colum. L. Rev. 1120 (1973) for a history of the polygraph's peripatetic trip toward legal respectability.

[3] Resnberger, *Heat "Pictures" of Pain Expected to Aid Sufferers, Detect Fakers,* N.Y. TIMES p. C-3 (Oct. 21, 1980).

[4] Browne, *New Police Technology Finds Tales of Crime in Molecules,* N.Y. TIMES p. C-1 (Feb. 3, 1981).

- *Scientific information for the court.* At present, most scientific information is provided to the court through the adversary process. Each party to the conflict provides his own experts to aid in the interpretation of evidence — accident experts to evaluate the physical evidence of an auto collision, psychiatrists to evaluate the mental condition of the defendant, and so on. There has been considerable dissatisfaction with this, which has led to proposals that judges be provided with data banks of science information and clerks trained in science to interpret it, that technically complex cases be tried to a court composed of judges who are trained scientists, that courts be provided with scientific advisors and to a change in the federal rules of evidence allowing judges to call expert witnesses on their own.[5] These proposals have raised severe questions about the role of the judge in the administration of justice. If he does not understand the facts presented to him, how is he to treat the parties according to the merits of their actions? But how can he avail himself of scientific advice and still maintain the supremacy of his normative judgment? How are normative questions to be kept from turning into descriptive ones?
- *Aids to judicial administration.* Considerable work is being done to systematize judicial administration, as with the computerization of legal files and judicial calendars.
- *Lawyer aids.* The computer is slowly finding its way into the practice of law through Lexis and Westlaw, the computerized legal research systems, and in various systems of law office management.[6] In addition, lawyers are increasingly working in teams with nonlawyers. Sociologists provide advice on selecting a favorable jury. Economists provide assistance in developing a legal strategy in antitrust cases.

Science and technology are rapidly changing the shape of the practice of law, as they have the practice of medicine. They are doing to law what bonus stamps did to retailers: If your competitor offered bonus stamps, you had to too, just to stay even. Similarly, when the other side ups the ante in a case by bringing in tests and experts and

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[5] Leventhal, *Environmental Decisionmaking and the Role of the Courts,* 122 UNIV. PA. L. REV. 509 (1974).

[6] A fine compendium of electronic technology available to the practicing lawyer is provided by Gara and Naegeli in *Technological Changes and the Law – A Reader,* Buffalo, William S. Hein and Co. (1980). Numerous consulting firms have sprung up offering lawyers assistance in finding their way through the technological jungle, such as Law and Technology Associates in New York City.

reams of data, they must be matched. The competitive edge goes to firms that can most effectively access and capitalize upon technological information.

If one party to a controversy has access to its own experts, as is often the case with government agencies and large corporations, it may not be possible for the other party to sue them at all because the funds and time are simply not available to hire the requisite experts and sort through what will surely be a torrent of technical data. This problem has particularly bedeviled plaintiffs who complain of employment discrimination and those who object to a governmental regulation.

By deepening our understanding of the world, science has made it possible to probe things that were once conjecture. We have learned from medicine that this knowledge can lead to powerful new treatments. But we have also learned from medicine that it can shift our attention from health to treatment, in law, from justice to proof. There is a danger that we will become good at proving things that no one understands, that judges will become divorced from the running of their courts and from the language of the witnesses, and that those who are rich in information will have disproportionate power in the judicial process.

2. *Scientific information forcing a reexamination of law*

- The life of the law, according to Holmes, is experience, not logic. Laws and rights, once formulated, are constantly reexamined in the light of experience and reformulated. Science studies experience and offers a powerful way of evaluating law. The leading example here is the studies that were done of educational segregation and brought before the Court in Brandeis briefs, leading to a reversal of the separate but equal doctrine in *Brown v. Board of Education,* 347 U.S. 483 (1954). Scientific information is relied upon to answer the most telling questions, such as when life begins and ends.

3. *New technology compelling a change in legal doctrine or the development of new doctrines.*

- As new technology is devised which expands our ability to alter ourselves and the environment, law changes the way decisions are made. New medical technology, for example, has required courts to declare who decides whether an incompetent child should be sterilized[7] or forced to donate a kidney.[8] As organ transplantation

[7] *See, for example, In re Grady,* 170 N.J. Super. 98, 405 A.2d 851 (1979).

[8] *See, for example, Strunk v. Strunk,* 445 S.W.2d 145 (1969).

has become more effective, courts have had to decide what kind of a right people have in their organs.[9] Who "owns" an aborted fetus? That question was rendered nontrivial when doctors discovered that fetal tissue is useful in experimentation and transplantation. The development of new rights and rules is today most evident in medicine, but it proceeds continually in all areas of the law. Research into the water supply has led to discoveries which render once buildable land unbuildable; divorce migrates out of the law into the counsellor's office; the shift from paper money to electronic funds transactions requires a complete rethinking of commercial law; and so on.

4. *Use of scientific ideas, thought processes and investigatory techniques in law.*

- *Theories about law.* The systematic application of social science research techniques to the law has given rise to a new field of study — Jurimetrics. The aim here is to develop testable theories *about* law, about the way that law fits into general society, as distinguished from theories *of* law, that explain the inner workings of the system. Jurimetricians, if there be such a word, study the effect of court delays, the correlation between the compositions of juries and their awards, and the socioeconomic profiles of judges.
- *Theories of law.* Social science has been a source of several theories of law. Most well-known has been the economic analysis of law,[10] which regards the law as the decision-making process that is applied to allocate resources when market processes cannot work. The thesis is that law, particularly common law, approximates the solution that a market process would reach in the same situation. Other theories of law have been based upon physical science concepts, such as evolution and entropy.[11]
- *Legal education.* Scientific theories and information have been in-

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[9] In *Human Organs and the Open Market,* 91 ETHICS 63 (1980), Clifton Perry evaluates four ways of allocating body parts: (1) donation by a decedents or decedent's family, if decedent has made no premortem objection; (2) free salvaging by medical community, unless decedent expressly stated to the contrary before death (perhaps we will all wear tags one day that say, "Hands Off!")' (3) a trading system in which the donor, or his heirs, would receive medical credit; and (4) the sale of the cadaver or neomort organs.

[10] The leading statement of this theory can be found in Posner, *Economic Analysis of Law,* 2d ed., Little Brown and Co. (1979).

[11] *See, for instance,* the theory advanced by F.A. Hayek in *Law, Legislation and Liberty,* Univ. of Chicago Press (1978), which applies an evolutionary model to the processes of law.

troduced into legal education in the form of numerous "Law and _____" courses, which approach a study of law from the viewpoint of sociology, psychology, economics, or anthropology. These viewpoints are largely from social science, but it has been suggested that law students be trained in the scientific method and in key concepts of the physical sciences.[12]

B. The Political Process

1. *Technology utilized in the political process*

- As with any institution, the political process is to a great extent the creature of the technology that it employs. Politics was one thing in the age of railroad trains and community newspapers, something else in the age of airplanes and national television networks. Opinion sampling, election forecasting, image making, computerized fund raising, and countless other innovations have had a distinct, but very difficult to evaluate, impact upon politics. Some argue, for instance, that computerized fund raising tends to fragment the political process by making it possible for a politician to appeal to a highly distinct, individualized interest. His votes can be tailored to the desires of specific members of society.

Changes in the technology of politics create a demand for new law. The rules that govern politics are metarules — they are rules that determine how the rules that govern society will be made. The rules that govern the conduct of elections, the allocation of committee membership in House and Senate, and so on, define the context within which laws are made. These metarules are made with reference to a particular level of technology. When the technology changes, the rules must change with them. So with the advent of radio and television came, eventually, rules that limited the ownership of radio and television stations by public officials, rules that required the stations to give free time to opposing political views, and rules that required stations to air news events.

By changing the political process, technology makes deep changes in law. The response to these changes is partially in law itself, as new rules are formulated which control the use of the new technology.

2. *Scientific and technical information used in making laws*

- The political process is not as limited as the judicial process in its ability to incorporate scientific and technical information into law.

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[12] *Field, Science, Law and Public Policy: Meeting the Need in Legal Education,* 13 N.E. L. REV. 214 (1978).

Congress employs any number of aids to help it get and evaluate data, from professional staffs trained in science, to committee hearings at which scientists testify, to informal talks with scientists. Political officials are free to access scientific information in ways that judges are not. The incorporation of scientific information has become a critical part of the legislative process.

A number of commentators have found the relationship between science and politics troubling.[13] Some see the problem as the subjugation of the legislature to a natural alliance between scientists and government administrators — broadly referred to as "technocrats." The technocrats control information and by strategic use of it are able to direct the legislature as they will. The legislature becomes simply a sounding board for the technocrats. The proliferation of public and private policy studies institutes, research and development centers, and public policy think tanks troubles many.

To others the problem goes far deeper than simply the control of information. Science and technology generate not only information but also a viewpoint: The world exists to be engineered. Law is used as a positive tool to conform human behavior to a set of objectives. Power is centralized. Success is measured by cost-benefit analysis. Information (*e.g.*, student reading scores are lowest in states that do not have an "R" in them, say) itself drives action. As science expands information, the technological state heats to feverish activity.

C. The Administrative Process

1. *Scientific information used to formulate laws*

- The primary justification for the grant of broad law-making authority by legislatures to administrative agencies is the ability of the latter to process information about some area of society into effective law. The agencies command the staffs required to turn Keynesian economics, for instance, into effective regulation of the economy, or to take massive amounts of data about the water recharge cycle in a particular area and turn it into an effective land-use plan. The agencies can go further, undertaking scientific studies of the effects of a proposed law. The Department of Health, Education, and Welfare, for example, has conducted a research

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[13] *See, for example,* Miller, *Science Challenges Law,* 13 AMER. BEH. SCIENTIST 585 (April 1970); Ellul, *Technique, Institutions and Awareness,* 11 AMER. BEH. SCIENTIST 38 (July 1968); Daddario, *Technology and the Democratic Process,* LXXIII TECH. REV. 18 (July-Aug. 1971); and King, *Whither the Technological State,* LXV POL. SCI. QUARTERLY 55 (March 1950).

program into the effects of a guaranteed minimum income plan by running such a plan in several locations.

2. *Technology used to enforce laws*

- The application of technology to enforce laws is most obvious in the criminal law, where electronic surveillance, the national crime information system, television monitoring systems, and so on, have proliferated over the past decade. Analogous technology is being used to enforce pollution standards, marine navigation rules, and many other regulations. The administrative agencies have become a major source of demand for technology. The Environmental Protection Agency has funded the development of technology for monitoring radiation levels electronically and pollution by the Land-Sat satellite.

3. *Scientific studies of the effect of laws*

- Where the common law tested its rules by reviewing them in the light of the cases that were brought under them, administrative law can be tested in a more positive way. The promulgation of a regulation can be followed almost immediately by studies of its effect. Where the effect varies from what was desired, it can be reformulated or enforced in a different way.

It was noted in Part I of this article[14] that the quickening pace of the scientific revolution has been paralleled in the law by a shift from judge-made to legislative to administrative law. There are many reasons for this shift, but primary among them is that the legislature was better able to use scientific information and technology than the court, and the administrative agency better than either of them. In information gathering, the court is largely limited to whatever is supplied by the parties. And, since it is restricted to the case before it, it cannot often get an entire problem in view. In a case by a neighbor against a power plant for nuisance, for example, it might be clear that the plant is bothering the plaintiff plenty. But it is not clear what a ruling against the power plant would do to the supply of electricity and the court cannot do the research necessary to determine whether or not a ruling against the plant would cause it to adopt less noxious technology or just shut it down. In such a circumstance, the court tends to defer to the legislature.[15]

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[14] Gibbons, *The Relationship Between Law and Science,* 22 IDEA 43 (1981), at 52.

[15] The leading example of this in nuisance cases is *Boomer v. Atlantic Cement Co.,* 26 N.Y.2d 219, 257 N.E.2d 870 (1970), in which the court refused to issue an injunction against the cement company, forcing it to eliminate dust pollution. The court left it to state and federal environmental protection agencies to devise a cure.

The legislature has no limits on its ability to gather information. Its deficiency is that it is severely underspecialized for evaluating the information. Legislatures have responded by hiring technical staffs, expanding committees, and so on, but the number and variety of tasks to be done make it impossible for it to do much more than identify a problem area and appoint an agency to deal with it. Unlike courts and agencies, which can be increased in number without limit, the legislature is unavoidably a single, collegial body composed of people who are scientific and technological amateurs.

The administrative agency, on the other hand, is composed of experts. It is limited to a specific set of tasks, so it avoids much of the cacophony of the legislature, but it is not limited to cases brought before it, as is a court. It may act on its own to gather and evaluate information, and it may choose, within limits, the problems that it will address. The administrative agency is the law-making forum geared to the age of scientific sophistication and rapid technological change.

D. Science and Technology affecting general society, giving rise to a response through law

Science and technology affect not only the legal *process,* as outlined in A, B and C above, but also the *content* of the law itself. Most law arises in response to human nature itself, to changes in values, to natural disasters, and so on, but much of it is a response to changes wrought by technology.

1. *Developments creating opportunities*

- Generally, the opportunities created by scientific or technological developments are responded to through the market process, not through law.[16] But there are two cases in which law is involved. First, where the existing law has been shaped around one technology, it may be necessary to reshape the law to allow the new technology to develop. In the case of the technological and economic developments that made it economic to develop low-head hydroelectric plants, for example, state electric power and environmental laws had to be changed to allow the market to develop. The

[16] I use the term "market" here in its broadest sense to connote any voluntary behavior that is not driven by coercion. Technological developments are responded to through the market in a straightforward way, as with the development of computer service bureaus that followed the advent of second generation computers. Scientific developments are also responded to in a market-like way, as when hundreds of mathematicians and physicists redirected their efforts upon the presentation of Max Planck's quantum theory.

second use of law is the case in which the opportunity created is a public good. Here, the purchase will be directed by law.

2. *Developments creating hazards*

- The market does not respond nearly as well to the hazards presented by technological developments as it does to their opportunities. There is a tendency for producers to concentrate upon the benefits of new technology and hope that there will be no hazards or that they fall upon someone else. The gap between benefits and hazards is filled by law (which is one of the reasons why the law seems so negative to innovators). In theory, tort law should be able to rectify the imbalance. By placing liability on the producer for hazards that he creates, it should force him to avoid those that he can and insure against those that he can't. There are any number of weaknesses in the tort liability scheme.[17] A wide variety of administrative schemes have been created to make up for those weaknesses.[18] Examples include premarket clearance of new pharmaceuticals by the Food and Drug Administration, on-site inspection of the Nuclear Regulatory Council, and new car safety standards promulgated by the National Highway Traffic Safety Commission.

3. *Developments causing social change*

- Every technological development changes the established social order, a few of them profoundly, most trivially. This change will put pressure on existing norms and beliefs. Quite frequently, that change is resisted or channeled into acceptable paths. The law is frequently the mechanism by which that is done. Examples abound: laws restricting sex, violence and commercials on television; laws restricting the sale of contraceptives (struck down); laws against abortion (partially struck down); traffic laws. The most difficult problems have arisen, perhaps, with the impact of technology

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[17] Some of which are (1) the liability system acts after the fact, which is one thing when the danger is from a defective sewing thimble, something else when it is a defective nuclear power plant or sleeping pill; (2) the liability system works only upon producers that are financially responsible — a truly incompetent firm, or one that can cleverly hide its assets, may completely avoid control; (3) the liability system requires a close linkage between cause and effect; where a given effect, such as lung cancer, is contributed to by many factors, it is not easy for the court to single one of them out and assess liability against it alone.

[18] The administrative schemes do not replace the liability system. A manufacturer may comply with every administrative requirement, but if an injury occurs it is still liable in tort. Having complied with all of the requirements of the FDA in introducing a new drug is not a defense to a claim if that drug later hurts someone.

upon the workplace. While it may be true that technology increases the demand for workers, that is true only on balance. It tends to put particular workers out of jobs or to increase the demands upon their performance, requiring them to be reeducated. This has led to an entire history of laws: union work rules; building codes that require obsolete construction methods in order to protect the jobs of bricklayers, plasterers, etc.; any number of government programs to cope with the problem of "technological unemployment." It is not at all clear whether law directs technology toward preferred social ends or simply eases the pains of technologically-determined change.

4. *Scientific studies revealing or documenting presently existing dangers*

- Much law results from a demonstration by science that a presently existing course of conduct will lead to disaster of one sort or another. There are the Endangered Species Act, child neglect laws, regulations against cigarette advertising on television, toxic waste control laws, and so on. Much of the flavor of contemporary life is provided by the daily announcement of dangers lurking in the innocuous. Breakfast seems to have been particularly hard hit, with coffee, milk, bacon, eggs and cereal all shown to be terminal.

5. *Technological developments requiring or allowing new international relationships*

- Many technological developments create a demand for international agreement. Offshore mining, for example, led to a change in the law of the territorial sea and to an international agreement on the mining of the ocean floor. Similarly, satellite communication, pollution monitoring, air travel, and nuclear weapons have led to an ever-increasing web of international agreement. The need for the transfer of technology between nations has caused change in domestic intellectual property laws within each state. Whether or not technology is creating a "global village," it is clearly binding nations more tightly together in laws.

The five entries in this section have indicated the various ways in which scientific and technological developments drive law. The law that they drive is positive law, law aimed not at arranging rights in a way that makes relationships between people work well, but at results, at a configuration of ends (*e.g.*, clean water, low cancer rates, etc.) that are deemed worthy themselves. The shift from a law based upon rights to one based upon results is one of the most profound effects of science and technology. By pointing specifically to demon-

strable ills, providing a specific plan for their elimination and a monitoring scheme to see to it that the results are achieved, science and technology change law from a framework within which people relate to a set of control signals directed at a specific objective. Modern law comes to resemble the work rules and job descriptions of a bureaucracy.

II. SOCIETY AFFECTING SCIENCE AND TECHNOLOGY THROUGH LAW

A. Adjudicatory Constraints on Science and Technology

- Science and technology are subject to property, contract and tort rights, as are all other activities. The technology firm must organize under the same corporate laws as any other firm and is subject to the same constraints upon the securities that it sells. Courts often experience difficulty in adjudicating the highly technical cases that science and technology present, but the job of the court is the same in these cases as in all others.

B. Public Direction of Scientific Research

1. *By purchase*

- Governments purchase scientific research for their own internal purposes, as with research by the Navy into faster hull shapes for their vessels, and for the general good, as with the funding by the Department of Agriculture of research in hybrid grains. Some of the research is conducted by scientists who are employed by government (*e.g.*, the Geological Survey), some by contract or grant to private organizations (*e.g.*, Navy contracts with the Woods Hole Oceanographic Institution). There has been a long-standing debate as to whether Congress can sensibly direct scientific research[19] and whether the presence of the federal government has overcentralized science policy.[20]

2. *By technology forcing*

- "Technology forcing" is the term used to refer to a circumstance whereby government places demands upon private firms which they can meet only through technological innovation. The most well-known example is the automobile emission standards promulgated by the Environmental Protection Agency which required the

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[19] *See, for example,* Reagan, *Congress Meets Science: The Appropriations Process,* 164 SCIENCE 926 (May 23, 1969).

[20] *See, for example,* Dupree, *Central Scientific Organization in the United States,* 1 MINERVA 453 (Summer 1963).

auto makers to meet stipulated standards by given years. Meeting the standards required innovation. Presumably, the auto makers employed scientists and technicians who would have done other things with their time and in that way technology was forced into reducing emissions and out of some other development. The same effect occurs when the Air Force specifies the performance characteristics for a new plane that can't be met with existing technology.

C. Public Regulation of Scientific Research and Technological Development

1. *Direct regulation of scientific research*

- The only direct regulation of scientific research by government is contained in the terms and restrictions in its grants and contracts with private firms, such as the standard provision that any patents that result from the research conducted under the contract will not apply to the government. The notable exception to this proposition is the controls that the National Institutes of Health placed upon genetic research requiring researchers to register with NIH and conform to a strict set of research guidelines. They applied to everyone working in the field, whether operating under an NIH contract or not. The possibility that this sort of constraint may be a thing of the future has caused many scientists concern.

2. *Indirect regulation of research*

- Research activities fall under any number of general regulations. In recent years the most notable of these has been the Occupational Safety and Health Administration's stringent treatment of worker safety in the laboratory. Because of the dangerous chemical and biological agents frequently handled in laboratories, OSHA directed particular attention to them, mandating innumerable safety precautions and raising the cost of research considerably.

3. *Regulation of inputs into science and technology*

- In a very limited way, government has imposed controls upon the human and nonhuman inputs into research and development. This is largely in the form of licensing, both the licensing of professionals and the licensing of the use of radioactive materials and other dangerous substances.

D. Public Support of Technological Development

1. *The patent system*

- The patent system fosters technological development by reducing the ability of firms to take a free ride on innovation. Innovation is expensive. If firms could free ride on the new ideas of other firms,

the tendency would be to do so, thereby reducing the costs of innovation and reducing the tendency to innovate.

2. *The taxation system*

- The federal tax system has a number of special provisions designed to favor innovation, such as the investment tax credit (which tends to heighten the demand for capital goods) and the depreciation provisions (which make it cheaper to substitute new technology for old).

3. *The education system*

- Support of science and technology is achieved through public education, science scholarships and fellowships, award programs, science competitions, and so on. In addition, there are public programs to retrain those who have become technologically unemployed and to train specific groups of people (*e.g.*, farmers) in new ways of doing things.

4. *Information services*

- Many government agencies undertake to store and disseminate scientific and technical information, often at minimal charge. The National Technical Information Service, for example, maintains a data base of government-funded research which it makes available to the public in the form of on-line computer access, hard copies, or magnetic tape.

5. *Other support*

- Government provides a number of services in support of technical development such as the National Bureau of Standards, which provides uniform standards of physical measurement, materials research, and technical services, such as the translation of technical articles into English. In some cases, government will also provide protection of some industries from the law itself. The most noteworthy example of this is the Price-Anderson Act, which limited the liability that operators of nuclear power plants would be subject to if the plant failed and caused injury. Without that shield from potentially enormous liability, private development of nuclear power would most likely not have occurred.

The purpose of a taxonomy is to provide a systematic way of understanding the common properties of apparently disparate phenomena. As the above list reveals, the points of contact between law and science are nothing if not disparate. It would, no doubt, be difficult for the judge who is trying to decide whether or not he should admit polygraph evidence into the trial, the lawyer who is trying to decide how to

marshal social science research data behind an argument that in his case a wife should be allowed to testify against her husband, a legislator who is trying to decide whether to support a repeal of the Delaney Amendment (which requires that the FDA ban any food additive where there is *any* laboratory evidence that it causes cancer), and the public administrator who is trying to carry out the provisions of 15 U.S.C. 1151-1157 requiring him to make certain technical information available to the public, to accept that they are all doing the same thing. In the largest sense, however, they are, for they are all involved in fitting the law to a world that is different because technology has changed it and seems different because science has revealed it to be what it did not appear to be. The taxonomy allows us to see the common patterns in the law/science relationship, to study them and to base law upon that understanding.

CURRENT LITERATURE IN LAW/SCIENCE: POLICY AND INTELLECTUAL AND INDUSTRIAL PROPERTY

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COMMENTARY
Infringement in the U.K. under the Patents Act 1977

Introduction

Every so often the legislature comes to the conclusion that the law, which is often working well, nevertheless requires change. This may be because of apparent perverseness, because of a general feeling or movement for change, or because of outside forces. Patent Law is not exempt from these pressures, which has resulted in the enactment of statutes dating from 1623 (*The Statute of Monopolies*) to the more recent Acts of 1907, 1932, 1949 and now the *Patents Act 1977,* which we will refer to as "the new Act." This last Act, which repeals substantial sections of the earlier Acts, arose out of the apparent necessity to harmonize domestic law and the new 'international' legislation, notably *the European Patent Convention* ("EPC"), the *Community Patent Convention* ("CPC") and the *Patent Co-operation Treaty* ("PCT"). The EPC and PCT are the only ones extant at the present time. The CPC has to be ratified by all member-states of the European Economic Community ("EEC"), such ratification being unlikely in the near future for political reasons. Nevertheless, because of the changes brought about in domestic law by the advent of the *new Act,* and because of the House of Lords decision in *CATNIC COMPONENTS LTD. v. HILL & SMITH LTD. (1980) (FSR Vol. 7 Feb. 1981)* which may well have repercussions on the approach to the question of interpretation of claims for years to come, I thought that a consideration of the recent *Patents Act* in the light of the House of Lords decision in *CATNIC COMPONENTS v. HILL & SMITH* would prove worthwhile, particularly as I was closely involved in this litigation as I act for the patentee.

The new Act is a departure, I think, because it sets out to codify the law of patents in the U.K. into a complete code and to this end the Act removes the prerogative to grant patents from the Crown and puts the onus squarely on the Comptroller of the Patent Office. This codifying approach results in a definition of infringement in Section 60, but currently there is no full definition of the term "invention" anywhere in the Act. However, Section 130 does define a "patented invention".

This term means, surprise, surprise, an invention for which a patent is granted, "patented process" being constructed accordingly.

Now we get down to brass tacks. Section 125 defines the extent of an invention, in other words, the scope of the claim. It is set out in terms that "an invention for a patent shall, unless the context otherwise requires, be taken to be that specified in a claim of the specification . . . as interpreted by the description and any drawings . . . and the extent of protection shall be deemed accordingly."

Subsection (3) of that Section states that the Protocol on the interpretation of Article 69 of the European Patent Convention (EPC) applies to this definition of infringement. Without going into the Protocol in detail, its main purpose seems to be to try to strike some balance between fair protection for a Patentee consistent with a fair degree of certainty as to what is protected.

Canons of Interpretation

Under the British canon of interpretation which is in many ways similar to U.S. law, the court takes the meaning of the words as their ordinary meaning, or at least the meaning which would be attributed to those words, in the light of relevant evidence, by a man of ordinary skill in the art, the notional skilled addressee, who at the date of publication of the specification knew what the relevant prior art was, and can therefore assess what is the meaning of a claim. Our courts are not therefore concerned with either the intention of the legislature, as are continental European Courts, or the intention of the draftsman when he drew up the patent specification. In my view, our law has not been altered by the new Act or by any recent law, in other words I think that the British canon of interpretation will still prevail in the U.K. courts even though our courts are expected to harmonize with Europe. Only time will tell, though.

Claims and Infringement

Now I think all will agree that the claims of a patent attempt to define the invention by generalizing the specific embodiment produced by the inventor. They are meant to encapsulate the inventive concept or principle but at the same time must have some mechanical structural elements and their relationship defined in order to show the realization of the invention in tangible form. It follows from this that the claim should not be too broad so as to encompass perhaps unworkable embodiments or to go beyond the true bounds of the invention, nor should it on the other hand be too narrow in scope, for some ways of carrying out the invention may not be covered, and infringement may thereby be avoided.

Ideally, the way to approach claim interpretation is to read the claim without reference to the infringement, though reference, even under our old Act, could be had to the body of the specification and drawings in order to decide what a particular word or phrase meant.

Having decided that, you have construed the claim, and you can then look at the infringement to see if it has the essential integers. If it has, there is infringement. Now this is fine but often for some reason a claim is not perfectly framed, so that an infringer does not have apparently every integer of the claim in his construction. He may have substituted one claimed integer for another, or varied a claimed integer in some way. For this reason, there grew up in the U.K. a second concept of infringement, called "mechanical equivalents" or "pith and marrow."

Pith and Marrow

Basically, I suppose one could say that this concept poses the question: "has a close workable approximation to the invention claimed being produced by the infringer?" If the answer is affirmative, infringement follows. Although there, the concept or doctrine of pith and marrow was not given much credence by our courts. In two celebrated cases which reached the House of Lords, the plaintiffs lost — no infringement. These were the precedents, but in a recent decision of the House of Lords, pith and marrow has been held to be defunct and the traditional British standard of interpretation has been re-stated. This case is the case of *Catnic Components Limited and Another v Hill and Smith Limited. (The Catnic* case).

The Catnic Case

I shall now try to bring these various strands together by specific reference to the *Catnic* case. It is, I think, unique in several respects. For example, it is the first mechanical case decided in the House of Lords since the advent of the new Act, their Lordships decided 5-0 in favour of the patentee and what is more restored the judgment of the judge in first instance and endorsed the dissenting judgment of the dissenting judge in the Court of Appeal but they arrived at their judgment by routes different from those of the two judges below who were in favour of the patentee. Thus both those judges thought that although there was not textual infringement there was an infringement by taking "pith and marrow" of the invention. The House of Lords were unanimous in their view that there is no difference between the two.

I can best illustrate the case by the following, which shows claim 1 of the Catnic patent, a diagram of a Catnic lintel covered by the patent in

position is a cavity wall, and DH2 and DH4, the two infringements. In the claim, the paragraphing is mine. In all other respects it is as considered by all the courts up to the Lords. It was held to be valid, and has never been amended since acceptance by the Patent Office, though its validity has been attacked (unsuccessfully) both in opposition and High Court litigation proceedings.

CLAIM 1 OF CATNIC PATENT

A lintel for use over apertures in cavity walls having an inner and outer skin, comprising:-

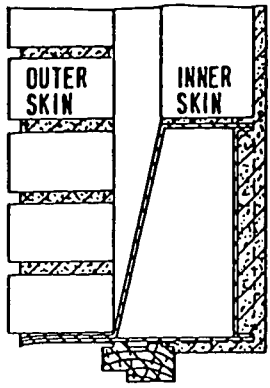
(i) a first horizontal plate or part adapted to support a course or a plurality of courses of superimposed building units forming part of the inner skin;

(ii) a second horizontal plate or part substantially parallel to the first and spaced therefrom in a downward vertical direction and adapted to span the cavity in the cavity wall and be supported at least at each end thereof upon courses forming parts of the outer and inner skins respectively of the cavity wall adjacent to an aperture;

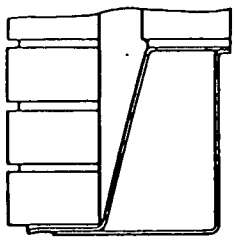
(iii) a first rigid inclined support member extending downwardly and forwardly from or near the front edge adjacent the cavity of the first horizontal plate or part and joining with the second plate or part in an intermediate position which lies between the front and rear edge of the second plate or part and adapted to extend across the cavity; and

(iv) a second rigid support member extending vertically from or from near the rear edge of the first horizontal plate or part to join with the second plate or part adjacent its rear edge.

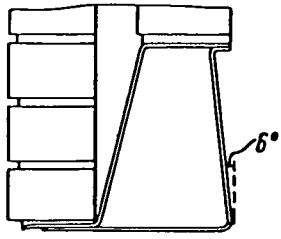
CATNIC LINTEL



DH 2



DH 4



DH2 was held to infringe. There was no appeal from the finding. In the case of DH4 the evidence was that sloping the back member provided a 10% increase in torsional strength, a 13% to 14% increase in torsional stiffness, a 10% increase in resistance to horizontal bending and a decrease in resistance to torsional bending about 1% to 2%. Therefore DH4 was slightly better in some respects and worse in one respect than a lintel with a vertical back plate. I should explain that lintels generally came in 2- and 3-courses. A 2-course DH 4 has an inclination of 8°, as 3-course, 6°-, these angles being the angles of the back plate off the vertical.

The case thus turned on whether DH4 infringed, in other words the question arises "does the claim cover a non-vertical rear support member?"

It is to be noted that the rear support member is not defined in the claim as being *vertical*. Rather, that it *extends vertically*. Also, the first support member is stated as extending downwardly and forwardly to join the second (lower) plate. These expressions have an adverbial quality in defining the way in which the respective members inter-relate. In other words they include the meaning that the second support member reaches between the two horizontal plates or parts from the respective points thereon specified — and you will also note that the second horizontal plate is said to be spaced from the first horizontal plate in a downward vertical direction — in other words below it, in use. In this case it is entirely consistent to say that the second support member extends vertically between the two horizontal plates.

The expression "extending verticlly" describes, for the skilled addressee, the function and spatial arrangement of the plates to which they refer.

Court of Appeal-Law

Sir David Cairns, in the dissenting judgment he handed down in the Court of Appeal, considered that there was nothing in the wording of the claims or specification to suggest vertically in the geometric sense as an essential feature of the rear plate. The majority decision against the patentee in the Court of Appeal though was that DH4 was not an infringement either textually or by "pith and marrow". Lord Justice Buckley gave the main speech in this judgment. I think that he got the law, at that time, right but applied it wrongly. He said: "To determine whether a claim of patent has been infringed one must first discover what is claimed. The claim must be construed and analyzed to ascertain what are the features — sometimes called the integers — of the subject matter for which a monopoly is claimed. The claim must be

construed in the context of the specification as a whole and in the light of any admissable evidence. It must be read and interpreted as it would be read and interpreted by the notional addressee of the specification, that is to say, a man skilled in the relevant art who has at his disposal the common knowledge in the art of the date of the publication of the specification. When so construed the claim must be analyzed to discover what are the several features of the thing for which a monopoly is claimed. One must next consider the alleged infringement to determine whether it infringes the claim. If the alleged infringement of the claim has all the features of the claim it must infringe the claim, even if it also incorporates other features. If it lacks one of the features of the claim it may or may not infringe the claim. If the feature which is lacking is an *essential* feature of the claim, there will be no infringement; but, if the feature which is lacking is an *inessential* feature of the claim the fact that it is wholly omitted from the alleged infringement or is replaced by some equivalent will not save the alleged infringement from being an infringement, for, if it has all the essential features of the claim it will infringe the claim not withstanding the omission of substitution of an inessential feature." He goes on to say: "so it becomes necessary to consider what distinguishes a feature of a claim which is essential from one which is not essential. This gives rise to the question in what respect the feature must be essential. Must it be essential to the practical working of the invention; or must it be essential to the validity of the claim; or will it be essential for the relevant purpose if the patentee has indicated that he regards it an essential feature of his invention, whatever its true essentiality may be; or will it suffice that the patentee has elected to limit his claim by the inclusion in it of the feature in question, thus disclaiming a monopoly in anything not incorporating that particular feature?"

So far, so good. His Lordship sets out the British way of doing things. His Lordship then, I think, became mesmerised by the concept of the vertical and this is, I think, where he applied wrongly the law he has so lucidly set out. For his Lordship then goes on to give an example in which an inventor of an apparatus explicitly states in his specification either expressly or upon construction that part A of the apparatus must lie at a right angle to part B and then claims an apparatus in which part A lies at a right angle to part B. Anyone, he says, who makes an apparatus for performing the same function which in other respects exactly resembles the inventor's apparatus but in which part A does not lie at the right angle of part B will not infringe. He goes on to say that in such a case it does not matter that it may not be essential to the successful working of the invention that part A shall lie at a right

angle to part B. His Lordship does concede that the specification may be less emphatic than the example given of A being at right angles to B. A specification may merely assume that anyone constructing such an apparatus would find it convenient to place part A at a right angle to part B without explaining as might be apparent to anyone skilled in the art that a deviation of up to say 10° more or less from 90° would not affect the efficiency of the apparatus. The specification must be read and interpreted as it would be by a man skilled in the art. In the modified case it might well be reasonable, he says, to expect that such a man would say to himself, "ah I see that he says 90° but obviously that must be interpreted as 90° more or less within normally accepted tolerances." If that is the right way to construe the specification and claim, then anyone else who makes the apparatus in accordance with the claim and with part A not lying at a right angle to part B but within accepted tolerances will infringe. This will be so because upon the true construction of the specification and the claim 90° is not an essential feature of the invention claimed or to put it conversely because on the true construction 90° more or less lies within accepted tolerances.

Evidence

If you apply these considerations to the *Catnic* case the evidence is that a DH4 type is not essentially different from a DH2 type which is an infringement. It will be recalled that the finding of infringement in respect of DH2 was not challenged on appeal. Then, Lord Justice Buckley instead of considering the claim as a whole tended it seems to me to split it up into different parts or even words. For example, he considered what "vertical" means in the specification as a whole and also what distinction is made between inclined members and vertical members in different parts of the claim. However, when he did this he is not comparing like-with-like because the member (iii) of the claim is a support member *and* a damp resistor plate. The so-called vertical member acts as a support member (iv) and also serves to prevent the need to put infill in the lintel between the top and bottom plates (i) and (ii). So having given the law correctly, Lord Justice Buckley compares the different features of the claim and because he wants to distinguish between inclined and vertical even though the claim does not state that the rear plate is vertical, he decides that the claim means strictly vertical. He found that this was an essential feature of the claim and therefore any construction which did not have it avoided infringement. Therefore DH4 was not an infringement and he set aside Mr. Justice Whitford's decision.

Lord Justice Waller agreed with Lord Justice Buckley, for virtually the same reasons.

House of Lords

Lord Diplock, handing down the unanimous opinion of the House of Lords, said there is not dichotomy between textual infringement and infringement of the pith and marrow. In other words there is only "infringement". This is defined by the claims, he said, as purposefully construed, that is not a *literal* construction. In other words I think he means by this that the claim would be understood by the skilled addressee. He did not go on to say what a skilled addressee was, and in the *Catnic* case, the House of Lords does appear to have taken the view that the skilled addressee is a builder rather than a lintel manufacturer — though probably in practice these two notional gentlemen would have had the same view as to what was required. The House of Lords went on to say that a claim is not to be taken to exclude minor variants if to a man skilled in the art it is apparent that minor variants are not excluded by the patentee, *such minor variants having no material effect on the way the invention worked.* The patentee, it should be remembered, is also skilled in the art. Bearing this in mind, it is, I think, easy to see why the claim covers DH4. Indeed, his Lordship made the comment during the Hearing that there *is* no difference between textual infringement and pith and marrow. *He* thought the claim was plainly infringed.

Conclusion

The *Catnic* case is an important one, I think, in several respects. Firstly, it is consistent with the body of law relating to the British canon of interpretation, which as you well know, derives from our common law approach. Secondly, it is consistent with our present requirements to harmonize with Europe, in that it accords with the Protocol on interpretation. Thirdly, it restates that the only question is "is a claim infringed?" and does away with a tag — pith and marrow — which tended to produce a dual approach to the question.

The case says there is only one approach and this must be good for practitioners and, more importantly, our clients.

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Reflections on the Betamax Decisions:

As most readers will know,[1] the 9th Circuit recently held Sony responsible for the acts of individuals using Betamax recorders to tape copyrighted broadcasts in their houses. While the case was remanded, there is reason to believe that relief consistent with the appellate decision is likely to interfere with the ability of subsequent Betamax purchasers to tape material off the air. Moreover, that will be true regardless of whether that material is or is not copyrighted and regardless of the circumstances in which taping of copyrighted materials may fit within fair-use limitations.

This is unnecessary to address what appear to be the concerns of the courts in reaching opposite conclusions, and it is unwarranted. It is unwarranted if there is a major impact on parties who were not even nominally represented in the litigation.[2] It is unnecessary because an unconsidered theory of liability[3] would permit an alternative, *e.g.*, to redesigning the Betamax so as to prevent its being used to tape broadcasts. However, before pursuing those matters, it will be useful to review the two decisions.

In *Universal City Studios* v. *Sony Corp. of America,* 480 F.Supp. 429 (C.Dist. Ca. 1979), Sony was exonerated from liability on each of a number of theories. Included were: (1) direct infringement, *id.* at 457; (2) contributory infringement, *id.* at 459; (3) vicarious liability, *id.* at 461; and (4) various "state causes of action," *id.* at 462. Having made a fairly careful examination of each, the court considered the second most plausible but nevertheless inapplicable. Given that individuals in their homes are *de facto* exempt from copyright liability and that this is buttressed, *e.g.*, by the right of privacy, the court analogized to the use of audiotape machines and found *de jure* exemption. Moreover, hedging a bit, the court pointed out that, regardless of the outcome on that issue: (1) there are any number of clearly legitimate uses of videorecorders, *id.* at 458-59; and (2) even with regard to off-the-air recording, a certain amount of material is available for copying notwithstanding the precise limits of the fair-use doctrine, *id.* at 468.

Having come to that conclusion, the district court again analogized — this time to contributory infringement as codified in 35 U.S.C. §271(c) and applied by the courts in patent cases. That section makes a

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[1] Indeed, because of the remarkable amount of media coverage, there may be few people who are *not* aware of the decision's potential impact on videotaping.

[2] There was a named individual defendant (William Griffiths), but, as discussed below, he was recruited by *plaintiff's* law firm and was unrepresented. 480 F.Supp. at 437.

[3] Induced infringement; *see* 35 U.S.C. §271(b). This too is discussed below.

seller of an article liable if the article is "especially made . . . for use in an infringement . . ., and not a staple article . . . suitable for substantial noninfringing use . . . ." Because of the capacity of the Betamax for noninfringing use, the court therefore ruled it to be a "staple" and Sony not to be liable for selling it; 480 F.Supp. at 461. Thus, notwithstanding exhortations in Sony's ads to "record favorite shows" or "build a library" and a failure to caution users about copyright infringement (except in a vague warning on p. 17 of an instruction booklet), *id.* at 436, Sony was free to continue as before.

The court of appeals was clearly upset by this result, 659 F.2d 963 (9th Cir. 1981), and went to the other extreme. It ruled, *inter alia,* (1) that Congress did not intend a blanket home-use exemption for videotaping, and (2) that the district court in analyzing fair use had put far too much emphasis on the, as yet, uncertain nature and extent of harm to copyright proprietors; *id.* at 965-74. It is hard to quarrel with the court's analysis respecting either of those propositions, but unfortunately it went further, raising the specter of a *de facto* if not *de jure* blanket *non*exemption for home use.

In direct contrast with the district court, it found the Betamax to be a nonstaple, observing that: "Virtually all television programming is copyrighted material. Therefore, videotape recorders are not 'suitable for substantial noninfringing use'." *Id.* at 975. Notwithstanding an appreciation of the difficulty of the task, it was but a short step to remand for what seems to be the primary purpose of fashioning relief; *id.* at 976. Also, in addressing that matter, it saw fit to add: "Once a determination has been made that infringement is involved, the continued profitability of appellees' business is of secondary concern." *Id.*

This is the sort of language courts use in dealing with scoundrels. However, in slamming the door on what it found to be an unacceptable way to earn a profit, the court carelessly caught the fingers of the public. As discussed in passing by the district court, and apparently not fully appreciated by the court of appeals, not a single home user was a *represented* party in the litigation. *See* 480 F.Supp. at 437. Implicit in the appellate discussion of staple/nonstaple, quoted above, is a finding that *no* home copying would be protected by fair use. Pursued to its logical conclusions with regard to relief, this may foreclose individuals whose interests are directly at stake from subsequently urging, *e.g.,* that while "librarying" may be beyond fair use, short-term convenience copying is not. Should persons who are unable to watch one program in a series be forbidden to tape it for later watching (and immediate erasure)? More importantly, should that issue be resolved when such persons lack more than nominal repre-

sentation? Regardless of the ultimate answer to the first question, "no" seems to be the only sound answer to the second.[4]

Does this mean that Sony should be free to encourage unrestricted home copying? That result also seems to be unwarranted, but it could be addressed by analogizing to the subsection of 35 U.S.C. §271 which addresses *induced* infringement [§271(b)]. Given the concerns of the court of appeals on the one hand and the lack of representation of Betamax users on the other, even that subsection is difficult to apply, however. At a minimum, the theory of induced infringement would permit an order restricting the scope of Sony's ads: a remedy far less extreme than one calling for design changes in the product — and one which would be less of an encroachment on the options of purchasers or sellers.[5] Optimally, an order under the theory of induced infringement ought also to call for prominent, affirmative cautions about the scope of fair use for home use of videotape recorders. Unfortunately, however, in the absence of a case in which it would be more appropriate to rule on the issue — or a statute which gives far better guidance than that contained in 17 U.S.C. §107 — such a caution would be impossible to write. Meanwhile, there seems no alternative but to prevent the manufacturers of videotape recorders from encouraging activities which may ultimately prove to be beyond the proper bounds of fair use.

As inadequate as that may be, nothing else seems possible given the present parties to the Betamax litigation and the state of the law. No doubt, it would be difficult to address two new issues at this stage of the proceedings. Yet, all things considered, this might be an easier problem to solve than the ones likely to be created by continuing to neglect those issues.

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Franklin Pierce Law Center

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[4] It is widely feared that videotape machines will no longer be capable of off-the-air recording, fair or not. If one is, in fact, incapable of doing an act, it is difficult to establish a case or controversy in which its legitimacy can be properly addressed.

[5] While somewhat wide of the mark, it is interesting to analogize to the legitimacy of filled milk statutes. In several decisions, federal and state *statutes* have been declared unconstitutional because they forbid the sale of a product in circumstances where it is more appropriate to regulate its advertising and labeling and where such statutes do not ban similar products. *See, e.g.,* Milnot v. Douglas, 452 F.Supp. 505 (S.D. W.V. 1978).

The Importance of Being an Applicant

Decisions published by the "United States Patents Quarterly" occasionally remind us of the criticality of a proper determination of inventorship (according to USA standards) prior to executing an application for Letters Patent. It seems that this particular aspect, which is often regarded as rather remote from technical realities concerning patent protection preliminaries (e.g., research, record keeping, data organization and analysis, preparing drawings and examples, drafting specifications and writing claims), has ramifications far beyond its relative* simplicity.

Full faith and credit is accorded an original designation, which is purposely made difficult to overturn, even to an applicant's detriment. Paying a price for an improper decision relating to inventorship is not limited to the uninitiated; even major corporations are not immune. The *Weekly Advance Sheets* (June 29, 1981) reports a case [*In re RCA Corporation,* 209 USPQ 1114 (Commissioner of Patents and Trademarks 1981)] concerning a patent that issued on an application for which joint inventors were named as applicants, and the PTO refused the assignee's request to correct the inventorship to that of a sole inventor, Kaplan.

Through interference proceedings the issue involved three parties, RCA, IBM and Bell Labs. Kaplan and Davidson, each of whom now considers himself to be the sole inventor, had been concurrently employed by RCA. Davidson is now employed by Bell Telephone Laboratories, Inc., an interference adversary of RCA. The Commissioner's holding confirms that an ounce of preliminary inventorship evaluation can be worth a pound of patent protection.

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*Determining the "correct" inventive entity for a specific invention often presents problems. Defining various aspects of the invention can lead to different types of claims which further complicate the designation of *the* inventor(s). Cf. Aisenberg, I.M., "It's Time to Quit Playing Inventorship Roulette", 56 JPOS 472, July 1974.

Comparative Test Evidence under Rule 132

The proposition that evidence (under Rule 132) to overcome a rejection based on 35 USC 103 should be commensurate in scope with claims [cf. *In re Dill,* 202 USPQ 805, 808 (C.C.P.A. 1979)], the patentability of which the evidence is submitted to establish, appears innocent enough and even logical at first impression. However, consider the two following types of situations which, although possibly more prevalent in chemical practice than in other arts, are certainly not so limited.

In the first example a claim is generic to subgenera A, B, C, D, etc., and art applied under 35 USC 103 is relevant, if at all, only to A. Since B, C, D, etc., are not rendered "obvious" by the art, there is no statutory justification whatsoever for requiring evidence commensurate in scope with the claim. All that is required by statute is to establish that claimed subject matter which appears "obvious" from available art is not, in fact, obvious therefrom.

The second example is, perhaps, more common. A claimed genus has a defined group of species which are clearly more closely related to those derivable from applied art than other encompassed species. If evidence fairly establishes that the most-closely related species of the claimed genus are patentably distinct from the art, no justification is seen for requiring evidence with regard to species which are more remote.

If there is one or a definable group of species in a claimed genus which is more-closely related to that which is derivable from applied art than any others, no basis is found for requiring evidence beyond that one or definable group to establish patentability for the entire genus.

When a prior-art and a claimed embodiment are compared, and provided evidence establishes patentability of the claimed species over that of the prior art, no further evidence should be required irrespective of the scope of the claimed genus if the selected prior-art embodiment was clearly more-closely related than another to any within the claimed scope and the selected claimed embodiment was clearly more-closely related than another to any within the purview of applied art. The same conclusion should be reached if the compared embodiments [one derived from applied art and the other(s) from within the scope of a claimed genus] are such that there is no reason to believe that a) either is atypical and b) other corresponding pairs are more-closely related.

It is easy to lose sight of the underlying purpose (to promote prog-

ress) of our patent system. Although reasonable safeguards are clearly required, precaution should be taken to make certain that applied safeguards do not unduly burden the entire system.

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PTC Research Report* ALTERNATIVES TO COURT LITIGATION IN INTELLECTUAL PROPERTY DISPUTES: BINDING ARBITRATION AND/OR MEDIATION — PATENT AND NONPATENT ISSUES

1. INTRODUCTION

Binding arbitration and mediation have gained increasingly wide, but not active support in recent years as an economical, private, and efficient device to settle intellectual property controversies. The question remains, however, whether the use of these alternatives to litigation is gaining in popularity in the industry sector and will continue to do so in the 1980s, or whether settlements achieved by the way of arbitration and/or mediation will remain a relatively small percent of the total number of settlements.

In hope of answering these and related questions, the PTC Research Foundation developed a survey to ascertain attitudes and trends in this area. The central theme of the survey is that of binding arbitration and/or mediation as an alternative to court litigation in patent and other intellectual property or related disputes. Of the 150 surveys mailed, 51 were returned, providing a substantial data base from which to extract current attitudes and some conclusions.

2. THE SURVEY

The survey consisted of 14 questions aimed at abstracting informa-

*Performed by Franklin Pierce Law Center researcher Arnito S. Muskat under the direction of Nancy Metz, Entrepreneurial Workshop, and Robert Shaw, Director, PTC Research Foundation in collaboration with the Academy of Applied Science and Jameson Lee and John C. Hou of the Massachusetts Institute of Technology, course 6.931, edited by Richard D. Sager. Prior articles of interest in this field include: *Patent Trademark and Copyright Arbitration Guide,* 53 J.P.O.S. 224, *Arbitration of patent and Other Technological Disputes,* 18 IDEA No. 4 (1977), and *Resolving Patent Disputes by Arbitration: An Alternative to Litigation,* 62 J.P.O.S. 337 (1980).

tion as to the present situation with regard to patent and other industrial property litigation and the alternatives which exist for industry today. The survey was distributed to attorneys employed by companies engaged in the manufacturing and/or licensing of intellectual property and expressing interest in activities of the Foundation.

The survey itself is primarily multiple choice with opportunity for comment. It has been reproduced in Appendix I. Comments appear in Appendix II.

3. DISCUSSION

As stated previously, 51 companies returned the survey out of 150 mailed. The figures and analysis below take into account only the returned surveys, with percentages rounded off to the nearest integer.

The responding firms turned out to be those to which a significant number of patents are issued each year; 86 percent have been issued 21 or more patents annually; while 33 percent have been issued 100 or more per year. No responding companies have been issued fewer than 11 patents per year. Thirty-five companies have been issued patents in the chemical field, 33 in the electronic or electronic field, 29 in the mechanical field, 10 in the biological field, and 12 in other fields. The data base under analysis here, therefore, is gathered from companies very active in patents in all of the major fields.

Of these companies roughly 25 percent have used arbitration and only 6 percent have used mediation to settle patent, know-how, or license disputes. The companies have used arbitration more than mediation by roughly a four-to-one margin. Litigation appears to be by far the most popular way to settle disputes, with approximately 70 percent of those polled never having used arbitration and approximately 90 percent never having used mediation as a substitute for litigation.

When asked whether they wished they had resorted to arbitration for certain disputes which they had litigated, 21 percent replied in the affirmative. Of those who replied affirmatively, however, 81 percent had never used arbitration before. Similarly, fewer than 16 percent of those experienced in the use of arbitration or mediation regretted the use of litigation. These figures suggest that some companies are willing to try other methods of settling intellectual property disputes, namely arbitration and perhaps mediation, but that their numbers are few, leaving litigation as the preferred method (though "preferred" by many having no experience with arbitration or mediation).

Of the companies polled, 29 percent stated that they were involved in litigation which they would consider settling by binding arbitration. Of these companies, 47 percent had used arbitration or mediation before. These figures further suggest a willingness, although limited, to

use alternatives to litigation, and that at least some companies which have used arbitration or mediation previously were satisfied with these forms of dispute resolution.

When dollar figures were introduced as a variable, the companies generally responded more favorably to arbitration and mediation as viable alternatives. For example, if the dispute involved less than $100,000, 69 percent said they would agree to arbitrate or mediate on the issue of validity, 71 percent on the issue of damages, and 73 percent on the issue of infringement. These results are quite divergent from the previous answers. As the dollar amount increased to more than $1,000,000, however, there was a marked hesitation to use alternatives to litigation, with the respective percentages dropping to 10 percent, 24 percent, and 14 percent.

From these statistics (see Appendix I, Survey Question #6) it appears that the willingness of the firms to use alternatives to litigation drops most significantly when the amount involved exceeds $500,000. Company patent departments also appear less willing to arbitrate a question of validity.

Of the 13 firms indicating a willingness to arbitrate when the money involved is over $1,000,000, only 3 have arbitrated before; none has mediated before. In addition, fewer than one-fourth of the companies that have previously used arbitration are willing to arbitrate when more than $1,000,000 is involved.

Forty-four companies expressed a preference as to those from whom they would choose an arbitration panel. Fifty percent of those responding chose professionals, 36 percent chose the American Arbitration Association (AAA), and 14 percent chose private sources. Of the 32 company counsel who ranked their preferences, 66 percent preferred private sources, with the AAA and professionals receiving 28 percent and 6 percent, respectively. These figures indicate that professionals are the preferred choice for an arbitration panel; they ranked significantly higher than private sources and even the AAA. In fact, professionals are preferred over private sources by better than a five-to-one margin by those who ranked both in a preferential order. It must again be pointed out, however, that a majority (66 percent) of those responding have not had prior experience with arbitration. The data, therefore, tends to reflect untried attitudes about rather than actual experience with any of the given alternatives.

Of the 40 firms which gave a definitive answer as to whether they would prefer to mediate a patent-related dispute instead of using binding arbitration, 58 percent stated they would not, while 42 percent

stated they would prefer mediation. Eleven of the 51 companies surveyed rendered no comment. Binding arbitration is slightly favored over mediation in this study group but this is not a highly-significant difference (only 3 firms).

When questioned if they would be in favor of an organization which furnished emergency mediation panels to settle disagreements which arise in the midst of important transactions concerning the foregoing matters, 15 of the 41 responding to this question, or only 37 percent, replied affirmatively. Also of interest is that 13 of the 17 who prefer mediation over binding arbitration would favor an emergency mediation panel. These 13 companies account for 86 percent favoring such a panel.

Extrapolating from the data might lead one to conclude that some companies (or their legal staff) have great faith in mediation while others do not. The fact that mediation is more controllable than binding arbitration may account for this seeming acceptance by some.

Turning to an issue related to patents, we asked the surveyees if they would consider using binding arbitration and/or mediation to resolve trademark, copyright, trade secret, employer-employee and like disputes.

Of the 51 responding firms, 69 percent stated that they would consider using arbitration; 59 percent stated that they would consider using mediation. On the negative side, only 12 percent said they would not even consider using arbitration, while 31 percent would not consider mediation. The rest were undecided. Just as there is a group viewing mediation rather favorably, there is also a group which is strictly opposed to its use.

On the whole, the answers show that the support for both arbitration and mediation surges when patent-related issues were excluded. In fact, 47 percent expressed support for both arbitration and mediation.

These figures suggest a willingness to try alternatives to litigation, especially when patents are not directly involved. It should be kept in mind, of course, that as before stated most of these companies have no actual experience with either arbitration or mediation. Thus the figures primarily reflect attitudes and not decisions based upon experience. Also of interest is the fact that 10 of the 16 who stated that they would never consider mediation in the heretofore mentioned nonpatent disputes have never mediated before.

With respect to the previous question, the firms were asked whether they would make a distinction on the basis of potential money damages. The response virtually across the board (from less than $100,000 to more than $1,000,000) was 50/50. However, the response

percentage to this question was disappointing; only about two-fifths of those polled chose to answer it in its entirety. In retrospect it appears that there may have been some confusion as to what "distinction" was referred to in the question (see Appendix I, Survey Question #11).

As to those specific ends for which the responding firms would use arbitration or mediation, 24 indicated they would use them to obtain a ruling stating what should be done by each party; 26 to lead to a set of fact findings; and 10 to lead to a legal interpretation of the issues. This last statistic may imply a preference either to leave legal interpretation to the courts or to ignore legal interpretations, although 20 percent are willing to allow that determination to be decided by alternative methods.

One can infer from this data that American firms do, for varied reasons, currently consider arbitration and/or mediation as viable alternative dispute resolution mechanisms. Some are willing to use one or both of them in a primary role (binding decision making) and some are willing to use them only in a supplementary role (fact finding).

Finally, we asked the firms what they viewed as the most important consideration in dispute resolution of the types discussed. Given first and second choices of the firms, two considerations emerged as most important: expense and expediency. These answers accounted for 78 percent of all first choices and 51 percent of all second choices.

4. CONCLUSION

From survey responses it seems apparent that the general trend of the responding companies is one which still avoids arbitration and/or mediation in the resolution of important intellectual property disputes, the word "important" meaning "high-monetary value." If, however, the monetary value is smaller, the evidence suggests an inclination which favors arbitration and/or mediation. In cases of high-monetary value, considerations of "validity" and "infringement" issues often detract from a particular company's propensity to rely on either arbitration and/or mediation. Furthermore, concern with the patent validity issue is apparently much more than that with either infringement or damages.

Some company counsel have bluntly admitted their dissatisfaction with formal litigation and are now ready to seek other alternatives to resolve disputes.

In general, responding companies regard dispute-resolution panels of professionals as their overwhelming choice over other alternatives.

Responses to the question of arbitration versus mediation in settling disputes have provided no definitive answers.

Companies also seem much more willing to use arbitration and/or mediation to resolve disputes which exclude patent issues.

Determining what the parties should do and fact finding are the roles most supported for arbitration and/or mediation.

The use of binding arbitration and/or mediation as an alternative to formal litigation appears no longer to be a mere academic research topic; there are very practical motives and desires existing today in American business to promote the use of arbitration and/or mediation in patent disputes which do not involve over $500,000 in areas excluding the issue of patent validity, and in areas of other intellectual property and related disputes more generally.

The PTC Research Foundation of the Franklin Pierce Law Center would welcome suggestions as to an immediate role it might play in:

1. **disseminating more information as to arbitration and/or mediation;**

and

2. **in the establishment and training of professional arbitrators or mediators for the intellectual property community.**

Please address your comments and suggestions to Robert Shaw, Director, PTC Research Foundation, Franklin Pierce Law Center, Concord, NH 03301.

THE PTC RESEARCH FOUNDATION

FRANKLIN PIERCE LAW CENTER

APPENDIX I

SURVEY

1. What is the total number of patents issued to your company yearly?

   a. 0 0 - 10
   b. 5 11 - 20
   c. 27 21 - 100
   d. 17 more than 100 Abstain 2

2. Please check the field in which the inventions have been made.

   a. 33 Electrical or Electronic
   b. 29 Mechanical
   c. 35 Chemical
   d. 10 Biological
   e. 12 Other (please specify) _____

3-A. Have you used arbitration to settle patent, know-how, or license disputes?

   a. 13 Yes
   b. 35 No Abstain 3

-B. Have you used mediation to settle patent, know-how, or license disputes?

   a. 3 Yes
   b. 47 No Abstain 1

4. Have you been involved in patent, know-how, or license litigation which on hindsight you wish you had arbitrated?

   a. 11 Yes
   b. 39 No Abstain 1

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5. Are you now involved in patent, know-how or license litigation which you would consider settling by binding arbitration?

   a. 15 Yes

   b. 35 No Abstain 1

6. If you were involved in a patent dispute, would you agree to arbitrate or mediate:

	Issue of Validity	Issue of Infringement	Issue of Damages
a. Less than $100,000 involved	35	37	36
b. More than $100,000 but less than $500,000	25	32	33
c. $500,000 to $1,000,000	9	14	15
d. More than $1,000,000	5	7	12

NOTE: The above figures refer to the companies that answered yes in each of the respective categories.

7. Rank the choices (1 first, 4 last) as to your selection of an arbitration panel.

   a. 16 AAA (American Arbitration Association)

   b. 6 Private sources

   c. 22 Professionals from given field

   d. 0 Other (please specify) _____

NOTE: The above figures refer to companies that answered (1) in each of the respective categories.

8. As opposed to binding arbitration, would you prefer the utilization of mediation panels to settle patent, know-how and license disputes.

   a. 17 Yes

   b. 23 No Abstain 11

9. Would you be in favor of an organization which furnished emergency mediation panels so as to advise and/or settle disagreements which may, from time to time, arise in the midst of an important transaction concerning the foregoing matters?

   a. 15 Yes

   b. 26 No Abstain 10

10. Since patent litigation and closely-related matters are said to involve public concerns, we have, above, separated those matters from other intellectual property; we now ask if you would consider using binding arbitration and/or mediation to resolve trademark, copyright, trade secret, employer-employee and like disputes?

	Arbitration				Mediation			
a.	35	Yes			30	Yes		
b.	6	No	Abstain	10	16	No	Abstain	5

11. With respect to question 10, would you make a distinction on the basis of potential damages of:

a. 14 Less than $100,000

b. 15 More than $100,000 but less than $500,000

c. 10 $500,000 to $1,000,000

d. 10 More than $1,000,000

NOTE: The above figures refer to the companies that answered yes in each of the respective categories.

12. If your company selected either binding arbitration or mediation, what would be preferred with regard to an ultimate decision?

a. 24 Decision stating what should be done by each party

b. 26 Fact findings

c. 10 Legal interpretation of issues

13. How do you rate the importance of the following factors, relative to the others, in dispute resolution on a scale of (1) - most important consideration to (7) - least important consideration?

a. 13 Speedy resolution

b. 4 Simplified evidentiary procedures

c. 25 Expense

d. 2 Finality

e. 1 Right of appeal

f. 3 Detailed analysis and decision

g. 1 Privacy of opinions

NOTE: The above figures refer to the companies that answered (1) in each of the respective categories.

14. Please comment in general on behalf of or against utilization of binding arbitration and/or mediation in the context of the foregoing disputes.

_____

_____

_____

APPENDIX II

COMMENTS BY THOSE ANSWERING THE SURVEY

Most of above overlooks business emotion that gets tangled in, for example, patent matters.

Mediation tends to "split the baby in half" as does a professional arbitrator, i.e., the latter hopes for work in the future. I would prefer a one- or three-person panel of experts who do not do arbitration for a living. I would prefer binding arbitration.

Arbitration agreement should require arbitrator(s) to make specified factual determinations, without permitting arbitrator(s) to decide what parties to suit must do; one danger of arbitration is that unless limited, arbitrator(s) may decide simply to reach a compromise between conflicting positions. If properly structured, arbitration is an attractive alternative to litigation.

It is important to have confidence in the arbitrator's impartiality--not only to the parties, but to the subject matter. I have used the AAA, but prefer judicial resolution of important disputes.

The problem with arbitration is the less formal structure can cause adversities to as great a degree as simplification unless controlled properly. Where the stakes are high I prefer the courts because of a greater chance of a balanced outcome.

Reluctance to arbitrate is due in large part to tendency of arbitrators to seek a "compromise" solution which may adversely affect other business considerations. For that reason, mediation (i.e., assistance in reaching settlement) may often be preferred.

Not practical in patent litigation.

Disputes of less than $500,000 value would seem particularly suited for arbitration in view of the very high cost and time delay in litigation of technological disputes.

Arbitration is not well-suited to resolution of intellectual property right matters which are too complex and abstract for such procedure.

I'm generally in favor. It is apparent that some cases do not lend themselves to resolution other than by litigation. Both parties must be in favor of arbitration or mediation. Otherwise the action will be inequitable.

Public policy questions scare me away from any decision-making process that does not include the blessing of the federal courts. I simply do not have the experience to give a meaningful answer to some of the questions. Perhaps it is time for a meeting; NY PLA in 1971; PTC in 1976; Q.PTC in 1982?

Patent litigation is so expensive, complex and prolonged that usually neither party is a winner. The success of patentees in jury trials may result in a preference for litigation by some patent owners. It is often difficult to

persuade a small corporate patent owner to enter into binding arbitration or mediation when the alleged infringer is a large corporation. I believe that two large corporate adversaries are more likely to choose arbitration or mediation.

Prefer qualified people working on informal unstructured basis, ending with final result with no detailed analytical opinion.

Actual decision to use either would be highly dependent on circumstances/context.

I'm troubled about the judicial viewpoint that resolutions of certain patent matters, e.g., validity is against public policy. Unless this changes, use of arbitration will not increase substantially.

Not yet ready for arbitration of validity.

Arbitration result should be appealable, but should result in simplification of procedure and focusing of issues.

Lawyers and litigants deserve professional judges. Private systems of justice do not provide them. Our system may not be good--but I'm sure worse are available.

Binding arbitration and/or mediation appears to have a place in settling disputes involving intellectual property. However, whether they are used is highly dependent on particular circumstances.

Arbitration is clearly needed as a mechanism to resolve disputes of medium financial importance. Today the cost and time required for litigation detract from, and sometimes even prevent, the fair resolution of such disputes. Litigating lawyers' fees are so high and the internal demands on people are so great that many good patent claims are not pursued simply because the recovery won't cover the total corporate expense.

Key elements are low cost, speed and well-reasoned final decision of arbitration in order to compete with normal litigation. If any of these are absent, arbitration isn't worthwhile. Furthermore, if damages are substantial, management of public corporations won't want to risk criticism for <u>not</u> litigating.

All should be available, so the parties can adapt to the prevailing circumstances. At present, the antitrust cloud inhibits arbitration or mediation, even if the parties are willing. Statutory remedy of this situation is probably required.

In general, both mediation and arbitration are quite favored for dispute resolution, even as to validity and infringement, to save both money and time. However, these modes cannot always substitute well for litigation so choice must depend on all the factors, including need for court validity decision vis-a-vis a number of infringers.

Arbitration is feasible when either party can really afford to lose--and only money damage (or license) is involved. I think it unlikely that patent disputes not settleable by the parties would respond to mediation.

Aside from expense, the main advantage is having a trier of facts who is competent in the technology involved in the dispute--this saves time and simplifies the evidence.

Generally feel arbitration leads to compromise which serious contestants can arrive at within a settlement agreement. However if arbitration expenses can be contained, arbitration should be an effective means to settle smaller dollar controversies. Where large sums are at stake the "winner-take-all" result of litigation seems inevitable.

Before I would try it, I would wait until several others tried it and felt the factors of No. 13 resulted in a positive feeling as compared to litigation.

Arbitration does not provide, in my experience, speed, or adequate analysis for decision. Hard to find qualified persons not already busy.

As the patentee I would favor binding arbitration in most cases. As the infringer I would favor mediation--reserving the right to take the validity issue to the courts.

THE RELATIONSHIP BETWEEN LAW AND SCIENCE, PART IV*

BY HUGH GIBBONS**

PART IV. Deciding About Technology — Solutions to the Law/Science Problem.

The relationship between law and science is a relationship between the two prime movers of social change: values and understanding. Values are not, in and of themselves, sufficient to produce change. We may want to eliminate racism or poverty, but, until we understand how to do it, that desire is frustrated. Values must be backed by understanding to be effective. Understanding, on the other hand, *is* sufficient to produce change. As our understanding of electronics grew, we produced television, which produced a video culture that was not *wanted,* or even imagined, by anyone. The techniques that we learn and the tools that we use change us in ways that we are often not aware of until long after the change occurs. By that time the value question — do we *want* a video culture? or suburban sprawl? or mutual assured destruction? — is moot. We live with what we get.

It is that property of science and technology, their capacity to produce change that was not motivated by desire, that I will take up in this part of the paper.

In Part I of this paper I surveyed a number of the problems that commentators have seen with the law/science relationship. Those problems are diverse, but they share a common theme: the perceived disconnection between values and change. Some applauded the disconnection, looking with horror on the proposition that the law should

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*This is the last part of a four part article. Part I, *The Law/Science Problem,* was published in IDEA, vol. 22, no 1, p. 43. Part II, *Six Representations of the Law/Science Relationship,* appeared in IDEA, vol. 22, no. 2, p. 159. Part III, *Points of Contact Between Law and Science – A Taxonomy,* appeared in vol. 22, no. 3, p. 227.

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seek to control the direction of scientific discovery and technological development. Would any inventor ever get a patent if he had to file with his invention a social impact statement, detailing just what effect his invention might have upon the family or the neighborhood? Others were concerned about the disconnection, feeling that, while we must live with what science and technology have done with us so far, we must now use law to gain control of them. Law should not simply mop up after technology, easing the problems of small farmers dislocated by mechanized farming, constraining the most senseless housing developments, protecting an endangered species here and there. Law should be a positive vehicle for producing what is good.

In large part, deciding about science and technology is outside of law. Lawyers have no special insight into the wisdom of cloning or psychometric testing or solar power. On those and most other questions lawyers will do no more than voice opinions of varying merit in public disputation. If special excellence on those questions is developed, it will come from ethical philosophy, policy analysis, and the study of human values and technology, not from law. But there *are* three areas of decision about science and technology that are singularly within the province of law: (1) How should technology be employed in the legal process? (2) In what ways should law affect science and technology? (3) Under what scheme should decisions about science and technology be made? Unless it is clear that these questions should not be decided, that we should continue to use and adapt to whatever science and technology have in store for us without reflection, these questions must be addressed. All of the theorizing and moralizing about change in society will come to nothing if the law, the mechanism by which values are translated into controls, is unable to effectuate those values.

I will end this paper by proposing that these questions are the proper subject of study in a law school. Before that, however, I will take up each one to examine what others have had to say about them. Each question is normative; it asks what *should* be done and thereby raises basic questions about what the law is *for*. And each is based upon a weak or nonexistent descriptive understanding of law. Of what significance is a shift from printed law books to electronic storage in the way we think about law? Of what significance is the fact that the Constitution was written before the scientific/technological revolution and the rise of the technocrat? The poverty of our descriptive understanding of law means that we aren't going to come up with any lively answers to the three questions that I have posed anytime soon. But it also means that the law faces an exciting period of learning about itself.

How Should Science and Technology be Employed in the Legal Process?

If law is to be a factor in social decisions about technology, the place for it to begin might be with decisions about the way that science and technology are employed in law itself. The law is in the early stages of an electronic revolution that will radically alter the way law is practiced and may well alter the way law is thought about.

The law grew up in an age when it was cheaper to move people than information. Libraries stayed still and people came to them. The mail and the telephone allowed for the transmission of some information, but they were so thin that the practice of law remained pretty much a matter of face-to-face interaction.[1] The lawyer wanted to meet his client, his opponents, his jury face-to-face to size them up. Most of what he wanted to know ("Is this an honest person?" "Is he likely to pay my bill?" etc.) could not be adequately determined through the mail or on the phone.

The requirement of face-to-face interaction gave law a shape that we assume somehow to be immutable. It meant that lawyers and courts had to be located close to their clients, which drastically limited economies of scale so that the average law firm consists of two lawyers, one secretary and a few hundreds books. It meant that lawyers in urban areas would have cheaper access to information than their rural counterparts because of their physical proximity to libraries and courts. And it meant that the authority of law was displayed everywhere, with tiny courthouses dotting the landscape.

With electronics it becomes cheaper to move information than people. The library can come to the person through his Lexis terminal. The development of cheap video technology means that communication is not limited to words. Trials and negotiations can be conducted at long distance. One implication of this might be that excellent lawyers gain a greater edge over their not-so-competent brethen. In the face-to-face practice, excellent lawyers are limited by the fact that they move no more quickly than incompetents (unless they have the dash to buy their own airplanes). While they are moving, they aren't getting any advantage from their legal skills. If they are able to sit in one place and communicate electronically, their effective work time rises and they are able to service clients who before would have been

[1] This is one reason for the reluctance of an appellate court to overturn a trial court's findings of fact. The appellate court has before it the full written transcript. But much of the information in a trial — the "demeanor" of the witnesses, for example — does not make it into print.

prohibitively distant. Perhaps electronics will make the law more competitive.[2]

That is, of course, but one possible implication of electronics. Legal information will be reorganized when changed from print to electronic media.[3] This will change the way people think about law in the same way that the publication of judicial opinions did centuries ago. Electronics may also lead to a concentration of lawyers into fewer, larger firms and to a centralization of court systems.

It is difficult to predict the effect of technology upon institutions, but the law can learn from the way technology has affected other institutions. One lesson to be learned is that technology can eliminate an institution. The lesson of the oyster fishery on Delaware Bay will hopefully not be instructive.[4] Oysters were traditionally fished from sailing boats. When power boats were introduced at the turn of the century they were banned from fishing oysters by state law.[5] The motivation for that law seems to have been distributional: The sailing fishermen could not afford to switch to power boats, which were being introduced by outsiders. The ban continued until 1945, when it was repealed by the Delaware legislature. The effect was drastic. The power boats could get to the seed beds where oysters grew until they migrated to deeper water. The sailing boats had been unable to reach the seed beds and so were assured of a steady crop of young oysters to replace the ones caught. The power boats destroyed the seed beds, reducing the oyster population to a point where it could be virtually eliminated by its natural enemies. The oyster fishery ceased to exist in the mid-1950s.

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[2] Competition will also be favored by cheaper dissemination of information about lawyers to the public. At present it is very costly for clients to get information about lawyers. They are limited to word-of-mouth information and extremely thin printed information, such as that published in the *Martindale-Hubbell Directory*. An electronic data base will be developed which offers information about lawyers and their records to the customer via his home terminal.

[3] It is interesting to note that when West Publishing Company developed its electronic library system, Westlaw, it organized its data base by the same key number system that its printed law books used. Its competitor, Lexis, developed a new system, accessing judicial opinions and statutes by reference to words themselves, not to legal concepts. The key number approach has not prospered, and West is now reorganizing its data to make access to it more flexible.

[4] Muldoon, *Technology May Have Initiated Delaware Bay's Oyster Troubles*, 62 NATIONAL FISHERMAN 41 (June 1981).

[5] This is an example of a law/science interaction that would fit under section I. D. 3, Developments Causing Social Change, of the taxonomy presented in Part III of this article, 22 IDEA no. 3 at 227 (1981).

The Delaware Bay oyster disaster may provide no guidance to the assessment of the effect of new technology upon the law. But it does evince two typical problems in the incorporation of technology into practice. First, there is no reason to believe that the independent judgments of the people involved is an adequate way of deciding about technology. It was apparently in the individual interest of each fisherman to switch from sail to power, but the total effect upon all of them was disastrous. Similarly, it may well be in the best interests of individual lawyers and courts to adopt every new technology. But there is no reason to believe that the resulting decisions are in the best interests of all of them or of society as a whole.

The second lesson is that any organization exists in relationship to an outside environment. It may operate in a way that destroys that environment, as in the oyster case, or it may adopt measures that interfere with the job that it does. This has been the complaint raised with changes in the medical profession. There is no question that the hospital-based, highly-technological practice of medicine maximizes the number and effectiveness of medical procedures that may be delivered with a given medical staff. What is not clear is that medical procedures are what medicine is for.

Technology does not improve the performance of an institution across the board. It improves some aspects of the institution. There is a tendency for the institution to shift its emphasis toward those aspects. In medicine, this was a shift toward medical procedures. In law, it may be a shift toward documents. Word processing and duplicating equipment may enable lawyers to maintain the appearance of solving problems by providing a flurry of documents, while in reality they have simply automated solutions to past problems.

The impact of electronics on the law is but one aspect of science and technology that calls for assessment. Another that has been of particular concern is the incorporation of scientific information into the judicial process. The rapid rise in both the volume and sophistication of scientific evidence has cast into doubt the wisdom of having amateurs — judges and juries with no particular schooling in science — as finders of fact. At one time "fact" considered of testimony about *events* and it was assumed that anyone who had made it to majority was versed enough in the ways of the world to decide what events actually occurred. Increasingly, "facts" now consist of *explanations* of events. Where once the victim of an accident wound up with a "bad back," today he has a "narrowing of the intervertebral spaces" with such and such a probability that there will be thus and so disintegration of this

and that. When the case arises out of an accident at a chemical plant, the explanations get out of hand.

Two types of solutions have been proposed to this problem. One is to increase the sophistication of courts in dealing with scientific explanations.[6] Suggestions range from training lawyers in the hard sciences to equipping judges with scientific advisors and access to data banks of scientific information to trying technical cases before a science court. One of the difficulties with these suggestions is that legal controversies are *value* disputes. Usually, the value dispute involves a *factual* dispute (if it doesn't, it will be resolved without a trial), but the factual dispute is secondary to the value dispute. The job of the court is to make a value judgment, to decide which behavior was legitimate, which claims are justified. The tenacity of the jury system would indicate that it is important to the legal system to maintain a balanced, amateur judge of values. To reformulate the court toward excellence in understanding scientific explanations risks introducing systematic bias into value judgments.

The other approach to the problem is for the court to refuse to enter the stygian wilderness of science, forcing technical questions to be presented in layman's terms.[7] The judge must preserve the essential normative character of the trial, going only so far into technical explanation as can be understood and evaluated in value — or "legal" — terms.

This proposal raises a central conflict between law and science. In science, facts are supreme. To refuse to look more deeply into a phenomenon is heresy. In law, facts are secondary. Their importance derives from a tenet of justice: People should be treated as their behavior warrants, not capriciously. The central question in law, however, is what response should be made to what behavior? The essential feature of law is matching a particular response (a fine, imprisonment, money award, etc.) to behavior. The legal decision as to what facts are enough to support a judgment is very different from the scientific judgment as to what facts are enough to support a conclusion. Scientists have spent great effort developing tests of the sufficiency of evidence, such as the mathematics of confidence levels. Law must do the same. It is very difficult for a court to refuse to hear relevant

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[6] One change of this sort that has already occurred is an addition to the Federal Rules of Evidence (Section 706(a)) which allows judges to call expert witnesses themselves, freeing them from exclusive reliance upon the parties' experts.

[7] *See, for example,* Harold P. Green, *The Risk-Benefit Calculus in Safety Determination,* 43 GEO. WASH. L. REV. 791 (1975).

evidence. But if it does not, it risks creating a record that defies understanding. Factual abundance can produce legal imcompetence.

The conflict between law and science may go deeper than a difference in the importance of facts in the two systems. Laurence Tribe has argued that the form of thought used in science and technology, which he terms "instrumental rationality," is different from that used in law.[8] Instrumental rationality takes ends as given. Thought is directed at achieving those ends rationally. This may not be problematic in science, where the end — an adequate description of the universe — seems untroublesome. But it is troublesome when applied to technology and law. Who supplies the ends, the "problems," that the engineer solves?

Instrumental rationality would be less troublesome if technology produced only the ends that were intended. But "solutions" to "problems" have secondary and tertiary effects that are *formative* — that change those who implement them toward no intended end. Hollerith may only have been trying to simplify the process of keeping records, but he set in motion the development of the computer, with its revolutionary impact.

Instrumental rationality has produced a method of analysis, cost-benefit analysis, which has been incorporated into the law in a way that many find troublesome.[9] It is based upon the proposition that the benefits (values) of a project can be compared to its costs (the values that must be foregone if the project is undertaken) and the most profitable (greatest excess of values received over values foregone) projects undertaken. Quite apart from the question about whether values can be measured in a meaningful way, cost-benefit analysis ignores the formative effects of undertakings. The means that we employ to reach given ends themselves change us. The death penalty, might be a very effective tool against violent crime if it were swiftly and surely administered, but it might also make us into something that we do not want to be. Technological rationality has no means of addressing such questions, for it must assume a set of objectives. But what objectives are legitimate is precisely the question that law is about.

The law employs a noninstrumental form of rationality to address the question of ends and values. The difficulty is that it is largely

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[8] Tribe, *Technology Assessment and the Fourth Discontinuity: The Limits of Instrumental Rationality,* 46 SO. CAL. L. REV. 617 (1973).

[9] *See, for example,* Green, *supra* note 7 and Starr, *Social Benefit Versus Technological Risk,* 165 SCIENCE 1232 (1969).

intuitive, emphasizing such things as traditions and sentiments as guideposts to decision. Legal reasoning is not instrumental reasoning. The difficulty is that, in the face of a demonstration that the sterilization of incompetents is cost beneficial or the execution of pickpockets would reduce theft, law has no particularly intelligible reasons for rejecting them. There are sentiments expressed — the sanctity of the person or the punishment fitting the crime — but no instrumental reasons of the form: Given Objective A, behavior X, Y and Z should be employed to reach it.

Questions about the limits of technological rationality are brought to a head because science, in this case the science of economics, has provided law with a complete jurisprudence: economic analysis of law.[10] Economics, which sometimes bills itself as "the science of rational decision-making," provides a model for allocating values between competing interests, precisely the job undertaken by law and politics. Based upon the proposition that individuals should determine values, economic analysis of law favors markets wherever possible and, where not possible, legal and political processes that approximate market — "optimal" — solutions. There is a suspicion, however, that something is missing from this approach, that reducing collective decisions to approximations of markets eliminates a critical value that only enters at the collective level or that the economic, value-maximizing human being is a true human being with some key parts missing.

The questions presented by electronic communications, scientific evidence and economic analysis of law require a form of technology assessment by lawyers beyond the usual, cost-benefit assessment of technology that is done by business and government. We are not asking whether a new, improved machine is worth buying to replace existing equipment. We are asking that the affect of basic changes in communication, storing information, proving cases, and defining justice is upon the law. These questions are not easily answered. Worse, they cannot be answered at all in the standard "How do we get from A to B?" rationality of science. For that reason, law should expect little help from science in learning how to evaluate it.

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[10] Economic analysis was, in a sense, born with Ronald Coase's article, *The Problem of Social Cost,* 3 J. OF LAW AND ECON. 1 (1960). A comprehensive statement of the theory appears in Posner, *Economic Analysis of Law,* 2d ed. (1977). This work ignited a fire of criticism, a particularly lively example of which is Leff, *Economic Analysis of Law: Some Realism About Nominalism,* 60 VA. L. REV. 451 (1974). *See also* Baker, *The Ideology of Economic Analysis of Law,* 5 PHILO. & PUB. AFFAIRS 47 (1975); and Buchanan, *Good Economics – Bad Law,* 60 VA. L. REV. 483 (1974).

Laurence Tribe argues that the law itself must develop a new form of rationality, which he calls "constitutive rationality," in order to cope with scientific changes in law. Constitutive rationality focuses on deciding what it is that we want law to become and choosing means that lead in that direction, not to specified ends. That is a tall order. Perhaps the greatest contribution of science and technology to law will be to force us to ask ourselves how we operate and think, to force law to reflect upon itself.

In What Ways Should Law Affect Science and Technology?

For the most part, the values that the law applies come into the law through the political and administrative processes. I say "for the most part" because law does *embody* a particular set of values, which I called "parametric values" in Part II of this article.[11] The parametric values, contained largely in the Constitution and common law, establish a scheme for reaching decisions — republican government, free speech, private ownership, and so on. We will take up the question of the effect of science and technology upon these values in the next section. Here, we are interested in what happens when the political and administrative systems provide values to direct science and technology in the form of laws. How effective are the laws? How do they work?

We have seen in Part III of this paper that the law is used in a large number of ways to foster and control technological development. Laws give inventors exclusive property rights in their inventions, ban the use of particular technology (as in the ban of power boats from the oyster beds in the Delaware Bay example above), force technological development through regulatory standards that can't be met with existing technology, favor the purchase of new technology with tax incentives, and so on. How effective are these laws? Law has done very little to assess, as it were, its own technology. The engineer who designs a piece of equipment knows very well the comparative strengths and weaknesses of gear drives and belt drives. The social engineer is nowhere near as knowledgeable about the relative merits of purchases, subsidies, taxes, property rights, liability rules and regulatory standards in controlling science and technology.

Recently, concern about excessive regulation has promoted study of the effects of law. It has been proposed, for example, that the desire to clean up the environment would have been achieved more effectively through a taxation system than through the regulatory process ad-

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[11] *The Relationship Between Law and Science, Part II,* 22 IDEA no. 2, 159 (1981).

ministered by the EPA.[12] Research is also being conducted to compare directly the effectiveness of various legal approaches to the control of dangerous spinoffs from technological development.[13]

Concern about the way that law affects science and technology is most frequently voiced by scientists and engineers, many of whom feel that law is both excessively protective and needlessly incoherent. Harvey Brooks has gone a step beyond these complaints to suggest that law become part of a "social technology" movement.[14] He predicts that the great technological development of the next generation will not be in "hard" technology (which will continue to prosper) but in "soft" technology, the creation of marketing methods, financial mechanisms and information systems that favor the implementation of hard technology and ease the difficulties that change brings to the populace.

Law is an essential part of this social technology in two ways. First, law tends to be conservative, locking existing ways of doing things into governmental edicts. Law support the husband-wife family, metal plumbing, the automobile, and single-family dwellings, all of which can get in the way of change. Law must take technological change into account to avoid fighting battles to preserve the obsolescent.

Second, law can positively adapt itself to new technology, easing the way for change. A particularly good example of this is, perhaps, space law. At the present, there is not a great deal of substance for space law to apply to beyond complicated questions presented by communication satellites, but legal scholars have anticipated many of the questions that will arise and have proposed rules governing property rights in planets, the extension of state sovereignty to extraterrestrial objects, and so on. This reduces the risk of space exploration and exploitation somewhat and tends to facilitate development.

Law is not particularly well-adapted at the moment to respond either to Brooks' suggestion or to those who find the law a confusing melange of rules and regulations over science and technology, because law has traditionally been viewed as something to *do* — a profession — not something to *study* — a discipline. It was felt, perhaps, that the operation of law was intuitively obvious, so that anyone who could

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[12] *See, for example,* Wenders, *Corrective Taxes and Pollution Abatement,* 16 J. OF LAW AND ECON. 365 (1973).

[13] *See, for example,* two separately published studies by Michael Baram: *Report to the Ford Foundation* (1980), and *Final Report to the Administrative Conference of the United States* (1979).

[14] Brooks, *Social and Technical Inventions: Challenges to Legal and Political Institutions,* 22 IDEA no. 2, 131 (1981).

remember the Rule Against Perpetuities was immediately an expert in deciding whether or not the Rule should be amended or abolished.[15] The growing complexity of the society and the parallel complexity of the law mean that intuition is a weaker guide to law. And the rate of change is so rapid that the relaxed evolutionary approach to changing law means that the errors of this trial and error method can be very costly.

In Part I of this article[16] I observed that negligence law has the unanticipated effect of driving technological development by requiring that people employ the safest cost-justified means of achieving their objectives. When medical technology provides doctors, for example, with a new test for cancer, they must employ it or face liability for a cancer that could have been detected by using the test. Another tort doctrine, the doctrine of foreseeability, has similar unanticipated effects on technology. The doctrine cuts off liability for injuries caused by a person if that person could not "reasonably" have foreseen the effects that his action would have caused. This rule would not make sense if the tort system were an insurance system, intended to compensate a person whenever another caused him harm. But it isn't (yet). It is a safety system, designed to induce people to avoid hurting others. If they cannot foresee hurting others, it makes no sense to hold them liable since they could not take that into account in deciding initially whether or not to undertake the action.

Consider the effect of the foreseeability doctrine on technological development. I mentioned above that technology has not only direct effects but secondary and tertiary effects as well. The foreseeability doctrine (and others) cuts off liability for the secondary and tertiary effects, the deep effects that pop up only after a technology has been in use. The inventor of the numerically-controlled machining center is not held liable when machinists are injured by the machine as they try

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[15] This assumption did not prove particularly accurate in the case of the Rule. In a landmark case, *Merchants National Bank v. Curtis*, 98 N.H. 225, 97 A.2d 207 (1953), Chief Justice Kenison of the New Hampshire Supreme Court, among the most thoughtful of judges, held that the Rule was unduly harsh since it destroys future interests if, when they are created, there is *any chance* that they will violate the Rule, even if actual experience proves that the Rule was not violated. In an understandable show of good spirit, Judge Kenison announced that from that day on the courts in New Hampshire would "wait and see" whether the Rule was violated by actual events after the creation of the interest. That change, unfortunately, made a rule that was only marginally coherent into mush. The "wait and see" doctrine has been sporadically adopted by courts in other jurisdictions.

[16] *The Relationship Between Law and Science, Part I*, 22 IDEA no. 1, 43 at 58 (1981).

to master its complexities. The manufacturer of the machines is not held liable when it throws machinists out of work, requiring them to relocate at considerable personal cost.

Under traditional tort doctrine those who employed technology were liable only for the very direct, and usually physical, effects of the technology. But that is changing. Insurance ideas are creeping into tort law along with the expansion in the concept of causation. Innovators are being held liable for the distant effects of their actions, even though they made every effort to foresee the possible dangers and avoid them. We will probably not see a day when an action will lie by the survivors of Hiroshima against the estate of Albert Einstein for laying the theoretical foundation for nuclear weapons, but the law is increasing the exposure of innovators to liability. In a sense this eliminates a "subsidy" that the victims of technological change paid to those who benefitted from it. But it also changes the environment of science and technology, increasing the costs of innovation and the risk that a court somewhere will extend liability in a new and devastating direction. Will the developers of artificial intelligence one day be held personally liable for individual feelings of worthlessness from realizing that there are machines that can outperform them in every aspect of work and love?

It may be that the idea of individual rights that underlies the tort system will prove to be too cumbersome, too limiting, in an age of radical technology. Perhaps the law should shift from a scheme that attempts to avoid harms, a safety system, to one that socializes the cost of harms, an insurance system. Future technology may be inalterably harmful, at least in terms of traditional notions of what a person is, in which case a safety system would stop development.

The deep operation of the law has never been obvious. It has molded the way that people think about themselves and relate to each other. But it has not been important to understand those deep functions. Science and technology have changed that, both for the scientists and engineers who feel that law is a conservative force that needlessly gets in their way and for those who would use law to grasp hold of technology. Law is not simply a button that can be pushed to ring a bell in the house of reason.

Under What Scheme Should Decisions About Science and Technology be Made?

The last two questions are substantive questions about law and science. They are the legal analogs to questions that have been asked in every art, business and profession. Artists, for example, have asked

how art has been affected by technology and how it has affected technology, conducting seminars and workshops in the use of new techniques.

The question that we now ask is singularly legal: Whatever substantive decisions are made about science and technology, under what arrangement, what architecture, should those decisions be made? The architecture of decisions is established by law. Law provides, as it were, the floor, roof and walls within which decisions are made and life goes on. This is most obvious in the case of constitutions, which establish the vertical division of powers between layers of government and the horizontal division of powers within government between executive, legislature and judiciary. Courts act as a switching mechanism, allocating decisions between agencies, here trimming back and there allowing expansion.

Constitutions are only the tip of the architectual iceberg. Every rule of law defines who may decide what, under what conditions. Private property rules define a sector of decisions that owners may make over things without consulting anyone else. The business judgment rule defines those decisions that a corporation may make without review by a court. The political question rule identifies those questions which a court will leave to the legislature. Law *is* the architecture of decisions in society. Most of the law is made by judges.

Science and technology change not only the substance of decisions but also its architecture. They do it in a number of ways.[17] First, science reveals the consequences of decisions. Where those consequences are seen to violate existing principles of law, the law will almost automatically reallocate decisions over them. A great part, for example, of the trimming back of the prerogatives of private ownership of land is due to the demonstration by science that activities like dumping things in streams, clearing land and installing septic systems, once considered innocuous, have serious consequences. Judges have even dabbled with the idea that trees should have standing to sue,[18] making them, somehow, participants in decisions about their fate.

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[17] Much of this discussion is suggested by the work of Arthur Selwyn Miller, *Technology, Social Change and the Constitution,* 33 GEO. WASH. L. REV. 17 (Oct. 1964), and *Science Challenges Law,* 13 AM. BEHAV. SCIENTIST 585 (March-April 1970); Harold Lasswell, *Must Science Serve Political Power?,* AM. PSYCHOLOGIST 117 (Feb. 1970); and Barbara Gardner, *The Potential For Genetic Engineering: A Proposal For International Legal Control,* 16 VA.J. INTERNATIONAL LAW 403 (1976).

[18] *See* the well-known dissent of Justice Douglas in *Sierra Club v. Morton,* 405 U.S. 727, 91 S.Ct. 1361, 31 L.Ed. 636 (1972).

Second, technology provides systematic solutions to problems. Where once it was up to neighbors and friends to do what they could for unruly children, technology today provides counselors and psychologists to do the job. There is a shift of decisions toward formal, trained decision-makers, exemplified in the unruly child case by laws that allow forceful intervention by the state into the affairs of the family.

Third, technological developments allow for the centralization of decisions. Where once decisions had to be localized because the means did not exist for a central authority to monitor distant behavior, electronic communication and information processing make possible a detailed surveillance of local behavior. Officials of the Department of Agriculture, for example, can keep track of what is being grown on every acre of farmland in the country by use of satellite photographs, making it possible for them to administer crop restrictions without reliance upon local offices.

Fourth, technology requires the centralization of decisions because it ties together small systems into ever more interactive wholes. A decision to limit the development of data banks, for example, has implications throughout society. It becomes intolerable for Idaho to have one set of rules about them and Iowa another. The agency that makes the decision must be global enough to encompass all of the implications of the decision.

Fifth, science and technology create decisions that once did not exist, requiring law to decide who should make those decisions. It is now possible, for instance, for parents to select the sex of their offspring. Is this a decision that should be left to parents, or is there a "public interest" in the gender composition of generations?

These observations just scratch the surface of questions about the effect of science and technology on the architecture of decisions. A number of solutions have been proposed. Many do not involve the law, such as various calls for the reassertion of humanistic or Judeo-Christian values in public decisions,[19] the reorganization of society

[19] "The real issue today is the management of industrial society — a problem not of ideology but administration .... The fact of the matter is that most of the problems, or at least many of them, that we now face are technical problems (calling for) ... very sophisticated judgments which do not lend themselves to the great sort of 'passionate movements' which have stirred the country so often in the past." President Kennedy, quoted in Salinger, *A Thousand Days* (1965), p. 644. Many commentators see the shift from value to technical questions in government as a sham to hide the fact that values are now being injected by a technical elite. *See particularly* Ellul, *The Technological Society and Technology, Institutions and Awareness,* 11 AM. BEHAV. SCIENTIST 38 (July-August 1968).

into small semi-autonomous communities,[20] computer modeling of all decisions to reveal their hidden secondary and tertiary effects,[21] and forums to consider the larger questions of democracy, liberty and/or progress presented by science and technology.[22] We will take up four proposals that deal directly with changes in law.

1. *All Scientific and Technological Research Should Be Done By Public Corporations.*

Harvey Wheeler has asserted that one way to assure public control over science and technology is to require that all research and development be done by public corporations.[23] The problem, according to Wheeler, is that society is constantly driven by forces that are largely in private hands. The public does fund most science and much technology, but this control is weak. If all scientists and technicians were public employees, their every effort could be supervised and controlled. This would make it possible to exert regulations that are now unthinkable. With such power, it would make sense for the public to ask big questions about science and technology, because something could be done about the answers.

The poor level of public discussion of science and technology issues is most frequently attributed to the complexity of the questions that they present. Any number of plans have been implemented to deal with this, from mandatory science education in public schools and colleges to the requirement that the National Science Foundation spend a portion of its funds on science education. But serious discussion is probably hampered as much be feelings of powerlessness as incompetence. Technological change is seen as a natural condition, like earthquakes and volcanoes. When control is exerted, as with actions by the Environmental Protection Agency against toxic waste, the actions seem almost hopeless. The Agency must study thousands of chemicals one at a time to determine their toxicity. With thousands of new ones being

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[20] This idea has a curious continuing life. It is a staple of the "low tech/alternative society" view and surfaces in such unrelated work as Nozick, *Anarchy, State and Utopia* (1974), Ch. 10, "A Framework for Utopia," and Lasswell, *supra* note 17.

[21] Starr, *supra* note 9.

[22] Bertrand de Jouvenal proposed a "surmising forum" composed of a variety of citizens who would systematically study the social effects of science and technology in *Letter From France – The Technocratic Age,* 20 BULL. OF THE ATOMIC SCIENTISTS 27 (Oct. 1964). The forum would have a fact-gathering arm and would entertain concerns expressed by scientists and engineers. It would make recommendations for legislation and regulation.

[23] Wheeler, *Bringing Science Under Law,* 2 CENTER MAG. 59 (March 1969).

introduced each year, it becomes almost impossible to keep up, let along catch up. When standards covering a particular chemical are developed, the Agency must then identify the hundreds or thousands of producers and users of the chemical to regulate their treatment of it.

Public ownership of the technological process might result in greater control, so that a discussion of science policy could be seen to be fruitful. In the case of chemicals, development could be allowed only where research demonstrated that the chemical was benign or that its toxic properties could be contained. Thus invigorated by a sense of power over science and technology, the public might take its implications more seriously and shift its attention from a concern for the President's health and appetite to genetic engineering, computer networking and psychometrics.

The public ownership of science and technology would be a profound change in the architecture of decisions. It would foreclose entire sectors of private decision, place all science decisions under the direct control of law and place decisions in the hands of a single administrative bureaucracy. The attempt to control science and technology may produce a greater change in society than science and technology themselves. The dangers of such a change speak for themselves, but the fact is that science and technology produce such a basic change in the nature of decisions in society that coping with them itself yields revolutionary, and often unattractive, proposals.

Public ownership would control science and technology by centralizing and formalizing decisions about them. The following proposal would leave those decisions to the mix of public and private decision-makers that presently exists, but limit them more tightly by a revivifed set of individual rights.

2. *New Individual Rights Must Be Defined For the Technological Age.*

Scientists have recently developed a considerable interest in aborted fetuses.[24] It happens that, because their auto-immunity systems are poorly developed, they are an ideal medium for experimentation and a source of cells for transplantation into adults with minimal risk of rejection. Who decides whether the aborted fetus can be used for experimentation or to grow cells for transplantation? The mother? The doctor? The hospital? Or is it the first one to lay hands on the fetus, making rights in aborted fetuses sort of a gold rush type of process? Perhaps we will have an administrative board that meets Mondays to hand out fetuses.

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[24] Maugh, *Transplants (II): Altering the Donor Organ,* 210 SCIENCE 177 (1980).

Technology continually confronts law with new circumstances that require a reallocation of rights or the creation of new rights. A number of writers have argued that rights should be used as a more aggressive tool to control technology.[25] It is not at all clear what they have in mind by this, but it appears that they would favor the development of specific rights tailored to the threats to individual dignity and autonomy posed by particular technologies. To counter cloning and other new forms of reproduction technology, they might favor a right to be created by natural means. The person who was cloned or genetically redesigned would then have an action against anyone involved in the process — parents, doctors, and so on.

The rights approach has several advantages over the other mechanisms for controlling science and technology that we are considering. Unlike the last proposal, it does not centralize power over science and technology in the hands of a few, so it does not respond to the democratic difficulties that technology poses by making those problems worse. Rights are asserted by those who are affected by an action, which distributes power widely. It also limits power, in that those who get it, get it only relative to a specific ill, and ties power to a particular problem. It also makes everyone a potential prosecutor, reducing the chance that a claim will get lost in the public prosecutor's office.

Rights are a controlled form of anarchy. They limit the ability of one person to order the life of another. They control the positive use of power by government to arrange affairs in a particular order. They are, in other words, antithetical to the fundamental tenet of technology: the rational ordering of a system to achieve stipulated objectives. Rights assure that the elements of the system — people — may to some extent order their own affairs. Rights are a constant irritant to technologists. Were it not for rights, people could be moved far more efficiently, fed more cheaply, housed more economically. The fact that each person has the right to decide what to eat, where to live and how to move makes for a messy, lossy society.

For these reasons, rights are a promising approach to the control of science and technology, perhaps the only mechanism that is capable of doing that job. But one goes little distance down this path of thought before one is struck by the fact that very little is known about the genesis, dynamics or effectiveness of rights. It is eloquent testimony to the lack of scientific impulses in lawyers that they are innocent of information about the most powerful tool that they use.

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[25] *See* Ferry, *Must We Rewrite the Constitution to Control Technology?*, SAT. REV. 50 (March 2, 1968); Tribe, *Legal Frameworks for Assessment and Control of Technology*, 9 MINERVA 243 (April 1971); and Miller, *supra* note 17.

One thing that does appear to be true about rights is that they develop in an evolutionary manner. Initially established by a constitution, a statute or a judicial opinion, they are developed and shaped by the court in the light of cases that assert them. Judge Frankfurter put it this way:

> To rely on a tidy formula for the easy determination of what is a fundamental right for purposes of legal enforcement may satisfy a longing for certainty but ignores the movements of a free society. It belittles the scale of the conception of due process. The real clue to the problem confronting the judiciary in the application of the Due Process Clause is not to ask when the line is once and for all to be drawn but to recognize that it is for the Court to draw it by the gradual and empiric process of "inclusion and exclusion."[26]

The "gradual and empiric process of 'inclusion and exclusion'" is an evolutionary one, with statements of the rule being replaced by new statements developed case-by-case over the changing experience of legal controversies. There is a great deal to be said for this,[27] but there may be severe problems with it in an age of rapid technological change, particularly when we consider using rights to *direct* change.

First, rights *follow* change. The "empiric process" that Frankfurter talks about is an examination of what has actually occurred. If the world has changed, that will show up in a change in the rule. So the advent of the airplane meant that the earlier rule that property owners had a right to the sky above their land had to be destroyed because pilots could not be forced to negotiate with everyone whose land they flew over. Courts take technology as given, rewriting rules to conform to it. It is a little much to expect a single judge in one case to adopt a stand which stems the flood of progress. Only when a right is considered high in "fundamentalness" does it survive for long in the face of technological change. The metaphysics of "fundamentalness" is obscure and seems highly flexible on a case-to-case basis.

The second difficulty with an evolutionary process is that it can stop altogether if the period of its change is slower than the period of change in its environment. The leading example of this is the halt that occurred in physical evolution with the arrival of Homo sapiens. Physical evolution was too slow for it to adapt man to a rapidly changing environment. By the time that it would have produced a hardened chest, good for protection against stones, spears and arrows, man would have produced guns and nuclear weapons that made the hard chest excess baggage. Similarly, rights may have lost any independ-

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[26] *Wolf v. Colorado,* 338 U.S. 25, 69 S.Ct. 1359, 93 L.Ed. 1782 (1949).

[27] No one says more for it than Hayek, *Law, Legislation and Liberty,* Univ. of Chicago Press (1978).

ent, evolutionary force. Change in rights may simply be an effort to catch up with external change, a Maginot line mechanism that finally forms itself in time to fight the last war.

Rights are modified today in the same way that they were when technological change was much slower, by individual judges evaluating information presented to them by the parties to a case. The moving force in the evolution of rights is human intelligence and, with all respect, the court as presently constituted may not be an adequate forum to bring intelligence to bear on change. The information presented is highly limited. The cases are episodic, their subject matter changing radically from one to the next. Judges have little in the way of collegial interaction to help them sort out the problems. Worse, there is little time (or inclination?) to step back from the particular cases to consider the deeper aspects of the questions presented. Perhaps that was to be the role of the legislature, but in a modern state it is a forum of interests, not a surmising forum.

The result of these deficiencies is surprise in the way that rights work. Consider *Roe v. Wade,*[28] the case in which the Supreme Court held that states may not make abortion completely illegal. There is no sense in any of the opinions in that case that the Court might be creating a marketplace in aborted fetuses. Yet that is precisely what has happened. Prior to *Roe v. Wade* it would have been a criminal act to be in possession of an aborted fetus. Today it is not, which, when combined with the fact that science has now found a use for them, generates the gruesome question mentioned at the beginning of this section about deciding who owns the fetus.

Roe v. Wade produced other startling results. The advances made in medicine since that time now make it possible for the mother to learn of the genetic makeup of the child before birth. This allows her to abort for strategic reasons, such as the sex of the child. And it gives rise to an extraordinary type of claim: the "wrongful life" claim of a child born with genetic defects who claims that he should have been aborted and who demands damages for having to live life with a deficient endowment.[29]

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[28] *Roe v. Wade,* 410 U.S. 113, 93 S.Ct. 705, 35 L.Ed.2d 147 (1972), *rehearing denied,* 410 U.S. 959, 93 S.Ct. 1409, 35 L.Ed.2d 694 (1972).

[29] Courts have for the most part rejected this claim. *See Becker v. Schwartz,* 386 N.E.2d 807, 413 N.Y.S.2d 895 (1978); *Berman v. Allen,* 80 N.J. 421, 404 A.2d 8 (1979); and *Robak v. U.S.,* U.S. Dist. Ct., Northern Dist. of Ill., Eastern Div., *slip opinion* (8/11/80). The claim was allowed in *Park v. Chessin,* 60 App. Div.2d 80, 400 N.Y.S.2d 110 (1977), *but reversed on appeal,* 46 N.Y.2d 401, 386 N.E.2d 807 (1978). A California court, however, has accepted the argument. *See Curlender v. Bio-Science Laboratories,* 165 Cal. Rptr. 477 (1980).

Rights, like technological innovations, have secondary and tertiary effects that are not obvious. Technological innovations, however, are backed by science, which affords a theoretical and empirical framework for analyzing the innovations before they are put into action. Certain families of chemicals, for example, are known carcinogens. A new chemical that is a member of such a family can be controlled from the outset.

There is no analogous back-up for rights. They are created and changed largely on the basis of values — we do what we desire. If they have effects that we do not desire, those effects may show up later in court, ready to be trimmed away. But that is precisely what makes of rights a very troublesome tool to use to control science and technology. Science and technology, if they are healthy, change much more rapidly than rights. To subject them to the pace of rights at present levels of ignorance would destroy or distort them. Until there is greater understanding of the way that rights translate values into controls, they are not a useful mechanism for directing science and technology. The idea of rewriting the Constitution to adapt it to the modern age, proposed by Wilbur Ferry,[30] is an idea whose time has not yet come.

3. *Science and Technology Policy Questions Should Be Decided By a Separate Branch of Government.*

Harvey Wheeler has suggested that science and technology policy decisions should be separated from all other decisions and made by a separate branch of government.[31] Science policy is today deeply embedded in the operations of government. Rarely does it become a major political issue. It is done by the National Academy of Science, the Departments of Agriculture, Commerce and Defense, the National Science Foundation, and many other agencies as they support research, promote technological development, specify new equipment, and so on.

This arrangement presents two difficulties. First, since science and technology decisions are implicit parts of other policy decisions, they are rarely addressed directly. Occasionally, an issue such as the proposal to build the neutron bomb will be presented directly, but usually it is hidden in issues about the funding of NSF or the creation of a new watchdog agency.[32] As a result, public information and debate fail to develop.

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[30] Ferry, *supra* note 25.

[31] Wheeler, *supra* note 23.

[32] The creation of the Office of Management and Budget (OMB) gave great importance to cost-benefit analysis because that system was a primary mechanism by which

The second difficulty is that science and technology become the special domain of governmental agencies. This may lead to incompetent management, of the sort revealed in the smoldering controversy over the M-16 rifle, or to excessive political power for scientists and engineers, or to the development of a technocratic elite with its own agenda for progress.

The separation of science and technology decisions from others would reduce these difficulties. Wheeler suggests that the science/technology branch have its own nationally elected legislature, so that it would have an independent power base. There would be, perhaps, a Senate of scientists and a House composed of nonscientists. Its professional staff would consist of people from all arts and disciplines who would study the wisdom of suggested policies. This would create a demand for people trained in policy analysis, technology assessment and even law/science.

The science/technology branch would have jurisdiction over all decisions relating to the funding of research and development and to the employment of technology by government. It would presumably take over all of the functions of the National Science Foundation, and it would supervise those departments of the National Institutes of Health, the Army Material Development and Readiness Command, the Naval Oceanographer, the Geological Survey, and so on that related to research and development.

To see how such a branch might work, consider the case of the M-16 rifle.[33] During the 1950s, officers in the Continental Army Command began to consider development of a rifle that used light ammunition. Existing weapons used .30 caliber bullets. Lighter bullets offered advantages in carrying weight and "wound ballistics," the fact that a light bullet becomes unstable much more quickly when it enters the body, making it less likely that it will exit in a clean hole. The Command contracted with an outsider to design a rifle using .22 caliber bullets, the output of which was the successful AR-16. Had the science/technology branch been in existence at the time, this decision would have passed to it. The Command would have made its case for developing the AR-16 and the decision would be made publicly.

Despite its success, the AR-16 was not readily adopted by the Army. It ran afoul of prevailing ways of thinking about and using weapons and of existing special connections between procurement officers and

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OMB watched over other agencies. The decision to use cost-benefit analysis was of major significance to the operation of government, done without political question of any sort.

[33] Fallows, *M-16: A Bureaucratic Horror Story,* 247 ATLANTIC 56 (June 1981).

suppliers of .30 caliber weapons. As pressure mounted upon the Army to adopt the AR-16, it was subjected to the tender mercies of the Army Material and Readiness Command and the Ordinance Department. These agencies demanded the redevelopment of the rifle according to different specifications. The result was the M-16, a weapon of almost criminal insufficiency. The decision to redesign the AR-16 would also have been within the jurisdiction of the science/technology branch. This would have avoided the built-in biases of the existing ordinance system.

Science and technology policy issues are issues of change. Questions of change are beset by two types of difficulties. The first is inertia: the tendency of existing means to continue and of prevailing thought processes and ideology to be used to make decisions about the future. The second is dominance: the tendency of decision-makers to use their decisions to gain control over others and order new relationships. Allocation of science and technology decisions to a separate branch would reduce these difficulties by taking the decision out of the hands of those who have a commitment to the status quo and out of the hands of those whose power will increase if the change is made.

The AR-16 case is an example of the most specific sort of decision that would be made by the branch. It would also make global decisions about the direction of energy development, for example, and might even generate a number of general theories about the processes of technological change to guide its day-to-day decisions.

The heart of this proposal is its separation of science and technology questions from the run of policy issues. This sort of separation is not entirely unprecedented. It is the same sort of separation of decisions that exists between the legislature and the judiciary on constitutional questions. The legislature may do what it will, but its actions are subject to independent review by the judiciary relative to their conformity to the Constitution. The science/technology branch would go further than this, taking science and technology decisions out of the hands of the legislature and the executive (either of which would, of course, be free to propose bills to or make inquiries of the branch).

The branch would avoid most of the deficiencies of the first two proposals. It would centralize decisions, as would public ownership of science and technology, but it would vest those decisions in a political body and it would not foreclose private uses of technology. By operating on policies, it would be much more straightforward than the rights approach. Experiments could be undertaken and abandoned if they proved worthless, something that is not easy to do with rights.

This proposal presents its own difficulties, not the least of which is

that it would require an amendment to the Constitution. It would also create delay in administrative decisions and raise complex jurisdictional questions. It would be subject to intense pressure from special interests, which would suggest that it be located outside of Washington, D.C., in, say, Billings, Montana.

Even if it functioned well, however, the branch would not provide an answer to the problem presented by the fact that science and technology questions are truly international in scope. The same rules of physics and chemistry apply in Russia and South Africa as in the United States. A unilateral decision on genetic engineering, computerization, telecommunications or nuclear weapons, however deeply rooted in philosophy or human values, is unlikely to count for much. International competition will foreclose the most important areas of science and technology decisions. International competition in weapons technology may be insane, but it is surely more attractive in the short run than a unilaterial decision not to participate in it.

The next proposal addresses the international aspect of science and technology policy.

4. *Decisions About Science and Technology Should Be Made By Specially Constituted International Bodies.*

As a first step in this direction, Barbara Gardner has proposed the creation of an International Ethics Review Board.[34] The Board would be strictly limited to the consideration of the technology of human reproduction — cloning, gene manipulation, artificial insemination, etc. There are two reasons for this. First, reproduction technology is the only aspect of medical technology with unavoidable international implications. Second, it is important to limit the scope of the Board's jurisdiction to reduce the tendency for it to become involved in political disputes. Each area of international concern would have its own Board.

The Board would act as an international clearinghouse for information about reproduction technology. It would be open to scientists and technologists as a forum to present their concerns. It would promulgate suggested laws and regulations for controlling research in and use of the technology. Most important, it would suggest procedures for nations to adopt themselves to evaluate reproduction technology and to make decisions about it. The Board would have no coercive power of its own.

International relations are disciplined largely by the laws of compe-

[34] Gardner, *supra* note 17.

tition. Competition has a "ratcheting" effect: An improvement by one competitor forces the others to match the improvement. The trouble is that an "improvement" in this sense means only a competitive improvement, a change that favors the survival of the one initiating the change. Competitive improvements may be catastrophic, as in the case of nuclear weapons. It is this divergence between the competitive value of a change and the human value of it that creates the need for international control. It is quite possible to imagine the ratchet producing changes that no one prefers. If, for example, it proved feasible to clone an army of high-quality fighters, it might prove impossible for any major nation to refuse to do it, however abhorrent. The ratchet defeats the pursuit of values.

Within a state, the ratchet is defeated by laws that make it illegal for a person or firm to employ an army, possess certain weapons, and so on. There is no similar mechanism in international relations. Gardner's Board is not such a mechanism, but it would establish the underpinnings for one. It would point up the dangers in reproduction technology and allow nations to adopt a sensible set of internal controls to head them off. It might also provide an impetus for international collusion (in a competitive sense) to foreclose certain paths of competition.

5. *The Three Questions Presented in This Paper Should Be Made a Proper Subject of Study in Law School.*

Each of the questions presented in this paper is distinctly legal. This is not to say that they are entirely legal (though the second question is almost so). An adequate study of them would require the combined efforts of epistemologists, political theorists and systems analysts. But all of them are inextricably legal. They require people trained, and preferably experienced, in the evolutionary logic of law, in running a court, law library or law office, in negotiating conflicting claims within a framework of principles, and in dealing with the inner workings of legislatures and administrative agencies.

The institutions of law are not presently well-organized to study anything, where to study means to unearth that which has not previously been seen. There is, in fact, something illicit in a law school about looking for that which is not written down somewhere. If the impulse in the sciences is to look for propositions that no one has previously considered, the impulse in law school is exactly the reverse, to build arguments out of propositions that would be commonplace to a grade schooler. And there is little aversion to making those propositions over and over again. Where medical school deans must dragoon

teachers into teaching the basics, law school deans have no such problem, it being common in law school for teachers to have taught the same material out of the same cases for two or three decades.

This is appropriate for a profession that considers itself the storm anchor of civilization, but it is unlikely to be successful if the problem is not hurricane but a revolt among the crew.

Law schools possess many of the resources to undertake this task. It is not at all unusual for a given class to contain students who are highly trained in political theory, systems analysis and the other disciplines which must be brought to bear on the questions. At the present these skills are largely irrelevant, but they could be mobilized into a program of study. The time exists to do the task, it being the general consensus that for able students the third year of law school is at present of marginal utility and submarginal excitement. A program that provided a sequence of courses, from an introductory course in legal change through seminars in particular law/science areas to a flexible array of group and independent study opportunities, could mobilize student efforts into an effective research program that would at the same time prepare them for the profession.

The greatest difficulty would be in organizing a data base to support this activity. Information about law and science is plentiful but widely dispersed in any number of disciplines. Aside from a few pioneering bibliographies,[35] it is very difficult to access. A systematic law/science program would require considerable institutional support at the outset to solve the information problem and an efficient, computerized system to store and use the information once gathered.

Even at its best, however, the law school does not offer a complete form for the study of law/science. The focus of law students is on professional preparation, as it should be, and that limits their contribution to a theoretical undertaking. Full development would require either a research center, with a paid staff, or a graduate program. Within the past decade a number of research centers have been established at law schools, but these tend to be highly specific programs directed at solving the problems faced by consumers, petroleum refiners or builders of low-head hydroelectric plants. Theory development is more harmonious with graduate education. Most gradate programs in law, however, are directed at honing the students' professional skills in taxation, corporate law or international law. A law/science graduate program

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[35] *See* Cohen, *et al., Law and Science: A Selected Bibliography,* Cambridge, Harvard Univ. Press (1978); and Caldwell, *Science, Technology and Public Policy: A Selected and Annotated Bibliography,* Bloomington, Ind.: Indiana University (1972).

would be a departure from tradition, unless it could be tied in some way to professional preparation in administrative law or science policy.

During the past decade many major universities have formed graduate programs to study the various social dimensions of science and technology.[36] They are organized around science and human values, technology and social change, technology assessment, medical ethics, the human aspects of engineering, and so on. Not a single program focuses upon the law. This may change, but it will be difficult for them to study the law/science question adequately. The questions presented in this paper are distinctly *legal* questions. It is possible for a sociologist or systems analyst to say many interesting things about law, but they are just that — *about* law. The questions presented here are *of* law. While lawyers tend to be modest on the subject, they are trained to think and observe in a way that is systematic, yet unscientific. It is this thought process which must be brought to bear on the law/science relationship. That is unlikely to happen if lawyers are simply added to the existing graduate and research programs and made to fit the prevailing social scientific mold.

The law is a unique perspective on human nature in society. That perspective is worthy of development and application to the fundamental challenges that science and technology have made to law and society.

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[36] Examples include the Science, Technology and Human Values program at MIT and Harvard; the Science, Technology and Public Policy program at Indiana University; the Science, Technology and Values program at RPI; the Program on Human Values and Ethics at the University of Tennessee Center for the Health Sciences; the Man Technology and Society program at St. Louis University; and the Science in Society Program at Wesleyan University. In addition, there are numerous research organizations, presidential study commissions and journals dealing with various aspects of the science/society interaction.

CURRENT LITERATURE IN LAW/SCIENCE: POLICY AND INTELLECTUAL AND INDUSTRIAL PROPERTY

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