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THE SEMICONDUCTOR CHIP PROTECTION ACT OF 1984: IS COPYRIGHT PROTECTION FOR UTILITARIAN ARTICLES DESIRABLE?

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I. INTRODUCTION

Innovative integrated circuitry was the basis of the second industrial revolution of electronic technology. Integrated circuits perform vital roles in products ranging from communication satellites to digital watches, and greatly enhance computer capabilities.

Manufacturers of integrated circuitry often invest many years and millions of dollars designing, developing, and distributing their products, not all of which attain commercial acceptance. Competitors may select a successful circuit and, using a process of photolithography, manufacture unauthorized duplicates of the original device for sale to an established market, thereby avoiding the originator's costs.

Manufacturers seeking protection for their technological creations have found little solace in the safeguards supplied by existing intellectual property law. The trade secret, unfair competition, and patent laws provide little protection and copyright law does not extend to useful articles. In response to these inadequacies and to the demands of the semiconductor industry, Congress enacted the Semiconductor Chip Protection Act of 1984 ("Chip Act"),[1] which extends integrated circuit de-

1. Pub. L. No. 98-620, § 302, 98 Stat. 3335, 3347 (1984) (codified at 17 U.S.C. §§ 901-914 (Supp. II 1985)).

sign sui generis protection within a copyright-based framework.

To the extent Congress considered integrated circuit design worthy of intellectual property protection unavailable to other industrial designs, protection could have been provided under already existing copyright laws. Computer developments, however, required Congress to depart from traditional copyright principles to protect innovative programming efforts.

Extending intellectual property protection to utilitarian articles such as computer programs and integrated circuits under either copyright or sui generis copyright-like protection is not without costs. Such protection blurs the distinctions between copyright and patent laws. Further, monopoly power may be extended to utilitarian articles which fail to maintain the innovative standard demanded by the patent laws, resulting in the inefficient suppression of competition.

This Article begins by discussing integrated circuit design and the need for protection of such designs. To the extent protection is required, this Article asserts that copyright law provides the best means of protection. This Article explores the implications of extending copyright protection to integrated circuits, as well as to computer programs, and questions the wisdom of extending copyright to utilitarian objects without some modification of existing copyright doctrine. Finally, a framework of analysis is proposed for an area in which the patent, copyright, and antitrust laws collide.

II. INTEGRATED CIRCUIT DESIGN AND MANUFACTURE

Active circuit elements, such as transistors, combine with other components, such as resistors, capacitors, and inductors, to form electrical devices. At one time, these components were separately manufactured and then metallically wired together. Today, microelectronic technology allows fabrication of all of these components on a single semiconductor substrate ("semiconductor chip" or "chip").[2]

Silicon is the most widely used semiconductor substrate.[3] Introducing impurities into pure silicon ("doping") alters the substance's electrical properties allowing it to either insulate or conduct electricity.[4] Silicon's status as a semiconductor refers to its ability to either conduct or not conduct electricity after selective doping.[5]

Through a complicated series of operations, a single silicon sub-

2. Meindl, *Microelectronic Circuit Elements*, SCI. AM., Sept. 1977, at 70.

3. *Id.*

4. *Id.* at 72.

5. *Copyright Protection for Semiconductor Chips and Masks: Hearing on S. 1201 (The Semiconductor Chip Protection Act of 1983) Before the Subcomm. on Patents, Copyrights, and Trademarks of the Senate Comm. on the Judiciary*, 98th Cong., 1st Sess. 69

strate is imbedded with impurities creating thousands of components which are chemically connected (integrated). Together these components operate as a complex electronic circuit.[6]

A. CHIP DESIGN AND MANUFACTURE

The chip designer initially describes the electrical functions to be performed by the chip. Based on the general electrical function description, the designer then details the electrical specifications of the chip and charts out a schematic representation of circuits. Next, the chip designer arranges the physical placement of the electrical components. These two-dimensional patterns are then digitized for computer storage. The patterns are transferred to a glass reticle, known as a "mask."[7] (A series of two-dimensional masks used to construct a three-dimensional integrated circuit is known as a "mask work."[8]) The manufacturing process follows.

Silicon is grown, sliced into very thin wafers, and polished. The silicon wafer is oxidized and a layer of photoresistive material ("photoresist") is deposited on the oxide. A mask is suspended above the wafer and light is projected through the mask, "hardening" the exposed regions of photoresist. The wafer is then treated with developer and the unexposed, "soft," areas of photo resist are etched away revealing regions of silicon substrate. Impurities (generally boron, phosphorus, antimony, or arsenic) are deposited or directly imbedded on the exposed substrate. These impurities change the electrical properties of the silicon. A layer of conducting material such as polysilicon or metal is deposited over the entire surface of the silicon wafer. The conducting material is then selectively etched in a fashion similar to that used to

(1983) [hereinafter *1983 Senate Hearing*] (statement of F. Thomas Dunlap, Jr., Corp. Counsel and Secretary, Intel Corp.).

6. *Id.* Current chips contain more than 250,000 components compacted on a quarter inch square of silicon. *Id.*

7. *See generally* Meindl, *supra* note 2, at 72; *see also 1983 Senate Hearing*, *supra* note 5, at 68-73 (statement of F. Thomas Dunlap, Jr., Corp. Counsel and Secretary, Intel Corp.).

8. New technology eliminates the need for masks. Instead, the information from the original arrangement is digitized and stored. The information is entered into a direct write machine which draws the pattern directly onto the silicon wafer. The chemical insertion of impurities will then proceed as previously discussed. *See 1983 Senate Hearing*, *supra* note 5, at 73 (statement of F. Thomas Dunlap, Jr., Corp. Counsel and Secretary, Intel Corp.). Engineers are currently experimenting with electron bombardment of impurities into silicon. As with the direct write process, information from the designer's arrangement is computer stored. This data is then employed to guide the direct bombardment of electrical impurities into the silicon, eliminating the need for the chemical processes described in the text. *See id.* at 37, 39 (statement of Dorothy Schrader, Associate Register of Copyrights for Legal Affairs and General Counsel for the U.S. Copyright Office).

etch the oxide. The result of this processing is a basic metal oxide semiconductor (an MOS transistor), a building block for many integrated circuits. Repetition of the selective etching process produces a complete semiconductor.

B. CHIP PIRACY

Chip piracy is not as complicated as the process described above.[9] Based on the market response to new chips, the pirate determines which chips to copy. The pirate purchases chips to use as samples for copying. A test tape is made of the original to check against subsequent chips.[10] The chip is then methodically stripped with chemicals, layer by layer. As each layer is stripped, a photograph is taken.[11] These photographs serve as the pirate's chip masks. Using these masks, the pirate duplicates the chemical processes employed by the originator to produce identical copies of the original chip. After manufacturing copies, the pirate may exploit a market that was developed or created by the originator, without having invested in costly research, development, or marketing.

III. THE NEED FOR PROTECTION

Chip piracy undermines the process of innovative chip design and manufacture. In discussing the need for protection for integrated circuit design, Representative Don Edwards of California stated:

> The layout and design process, and the preparation of the photographic "masks" used to etch, deposit layers on, and otherwise process the chips often take the innovating firms years, consume thousands of hours of their engineers' and technicians' time, and cost millions of dollars.
>
> Yet, a private firm can photograph the chip and its layers, and in a few months, for a cost of less than $50,000, duplicate the mask work of the innovator. Because the pirate firm does not have the enormous development costs borne by the innovator, the pirate firm can undersell the innovator and flood the market with cheap copies of the chip. Such piracy is a clear threat to the economic health of our semiconductor industry.

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9. *See generally 1983 Senate Hearing, supra* note 5, at 74-77 (statement of F. Thomas Dunlap, Jr., Corp. Counsel and Secretary, Intel Corp.).

10. The test tape is a recording of the model semiconductor chip's electrical patterns and responses to electrical signals. Only chips which possess identical circuit architecture will generate a pattern of electrical signals matching those recorded on the test tape.

11. As the nature of chip construction has changed, chip piracy has also changed. These changes impact the nature of protection necessary for integrated circuit design. They may also impact our analysis of the need for specialized intellectual property protection of semiconductor design. *See infra* notes 19-28 and accompanying text.

> Continuation of this piracy eventually will make it impossible for innovator firms to continue their investment in the development of new chip designs.[12]

Semiconductor industry representatives focus upon two concerns in their pleas for design protection. First, they assert that the ability to recover the investment made in the development of a new product is reduced, and possibly eliminated, as a result of pirate copying.[13] This assertion centers upon the notion that pirates are unjustly enriched by the efforts of originators. Second, representatives of the semiconductor industry believe that the motivation for creative design work is diminished, if not destroyed, by pirate copying.[14]

When assessing these arguments, however, it should be recognized that:

> In most of the important fields of human activity it is not usually considered wrong to imitate valuable things, ideas and methods. The more acceptable to society the thing is, the more others are encouraged to imitate it. Education is founded upon this premise, as is progress in science, art, literature, music, and government. . . .
>
> Imitation is inherent in any system of competition and it is imperative for an economy in which there is rapid technological advance.[15]

Thus, the fact that copying occurs is not a sufficient reason to compel legislative intervention.

Nevertheless, there is concern that without at least some protection, innovators who are unable to recoup their creative investments will cease their efforts, resulting in diminished innovation and harm to

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12. *1983 Senate Hearing, supra* note 5, at 13-14 (statement of Rep. Don Edwards); *see also id.* at 75-76 (statement of F. Thomas Dunlap, Jr., Corp. Counsel and Secretary, Intel Corp.). The cost of developing a complete family of semiconductor chips (including research, development, and marketing) can reach $100 million, but a copier employing photolithography can concentrate exclusively on the attractive main chip, at a cost of only $50,000. *Id.* at 122 (statement of the Semiconductor Industry Association). The loss to a firm through a single incident of piracy can be in the tens of millions of dollars when revenues lost through price suppression and lost sales are considered. *Id.* at 78-79 (statement of Christopher K. Layton, Vice President of Operations for Intersil, a General Electric subsidiary). A single chip costs $500,000 and takes 2-3 years to develop, design, and market while a pirate can copy chips at a cost of $30,000 within 3-6 months.

13. *Id.* at 79, 122-23 (testimony of Christopher K. Layton, Vice President of Operations for Intersil, a General Electric subsidiary; statement of the Semiconductor Industry Association).

14. *Id.* at 79 (testimony of Christopher K. Layton, Vice President of Operations for Intersil, a General Electric subsidiary).

15. Rahl, *The Right to "Appropriate" Trade Values*, 23 OHIO STATE L.J. 56, 70, 72 (1962). *See also* American Safety Table Co. v. Schreiber, 269 F.2d 255, 272 (2d Cir. 1959), *cert. denied*, 361 U.S. 915 (1959) ("[I]mitation is the lifeblood of competition. It is the unimpeded availability of substantially equivalent units that permits the normal operation of supply and demand to yield the fair price society must pay for a given commodity.").

society.[16] Of course, providing protection for innovators would increase the costs of information dissemination. One of the goals of the copyright and patent laws is to balance concerns such as these and provide protection for innovators so that both innovation and dissemination of new advances in knowledge are encouraged.[17]

The patent and copyright laws are discussed in detail in Section IV of this Article. At this point, however, it should be noted that "[t]he economic philosophy behind the clause empowering Congress to grant patents and copyrights is the conviction that encouragement of individual effort by personal gain is the best way to advance public welfare through the talents of authors and inventors in 'Science and Useful Arts.' "[18]

Hence, the semiconductor industry's assertions of diminished incentives and unjust enrichment by pirates reflect the underlying theories which gave rise to patent and copyright protections. It is not clear, however, that these claims compel protection for the semiconductor industry. Losses from chip piracy are relevant only to the extent they deter continued innovation in chip design. It is possible that innovation will continue without extending current intellectual property protection to the semiconductor industry. Three factors support such a conclusion.

First, rapid innovation and technological change characterize the semiconductor industry.[19] The industry competes by continually marketing new products and maintaining cost advantages for those products. The reduction in cost is partially explained by a "learning curve": as an industry becomes more experienced, it becomes more efficient.[20]

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16. *See generally* F. M. SCHERER, INDUSTRIAL MARKET STRUCTURE AND ECONOMIC PERFORMANCE 442-52 (2d ed. 1980).

17. In Universal City Studios Inc. v. Sony Corp. of America, 659 F.2d 963, 965 (9th Cir. 1981), *rev'd*, 464 U.S. 417, the court discussed the purpose of granting copyright protection and stated:

> Despite what is said in some of the authorities that the author's interest in securing an economic reward for his labors is a "secondary consideration," it is clear that the real purpose of the copyright scheme is to encourage works of the intellect, and that this purpose is to be achieved by reliance on the economic incentives granted to authors and inventors by the copyright scheme. This scheme relies on the author to promote the progress of science by permitting him to control the cost of and access to his novelty. It is based on the premise that the exclusive right granted by the copyright laws "will not impose unacceptable costs to society in terms of limiting access to published words or pricing them too high."

18. Mazer v. Stein, 347 U.S. 201, 219 (1954).

19. *See Copyright Protection for Imprinted Design Patterns on Semiconductor Chips: Hearing on H.R. 1007 Before the Subcomm. on Courts, Civil Liberties, and the Administration of Justice of the House Comm. on the Judiciary*, 96th Cong., 1st Sess. 52 (1979) [hereinafter *1979 House Hearing*] (statement of John Finch, Vice President, General Manager, Semiconductor Products, National Semiconductor Corp., quoting D. WEBBINK, THE SEMICONDUCTOR INDUSTRY, FED. TRADE COMM., BUREAU OF ECONOMICS (1977)).

20. Noyce, *Microelectronics*, SCI. AM., Sept. 1977, at 63, 67.

Additional benefits are achieved by increasing output. For example, a manufacturer can reduce unit costs by twenty-eight percent by doubling production.[21] Such cost reductions exceed those available in most industries.[22] The learning curve advantage supplies a substantial impetus for continued innovation in chip design.[23]

Second, the first competitor to enter the market enjoys significant time advantages.[24] Each chip manufacturer employs its own unique manufacturing process.[25] The piracy process involves more than producing mask copies: the pirate must duplicate the manufacturing process as well. This takes time, and delays are costly, in an industry in which products have short profitability lifetimes.[26] Thus, lead time provides significant benefits, and decreases the incentive for pirate copying.

Third, pirating is not clearly advantageous for potential copiers. A pirate who waits to assess market success risks sales losses in a volatile field. A pirate who acts immediately may guess incorrectly and waste valuable time and money. Additionally, both patient and hasty pirates must invest money in a variety of manufacturing processes to fully capitalize on innovative chips designed by others. Copying, therefore, involves judgment and capital investment, and is not without risk.

These factors suggest that the threat of diminished investment returns to innovators resulting from copying by pirates may not loom as ominously as some claim. Moreover, although the loss of innovative activity resulting from the refusal to extend current protection to chip de-

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21. *Id.*

22. "[T]he development of the integrated circuit is unique because, although other industries have shown similar experience curves, the integrated-circuit industry has been unique in its annual doubling of output over an extended number of years." *Id.*

23. Furthermore, new technologies, such as electron bombardment of silicon, generally increase the impact of the "learning curve." *See supra* note 8.

24. *1979 House Hearing, supra* note 19, at 64 (testimony of Alan MacPherson, Patent Counsel, Fairchild Camera & Instrumental Corp.); telephone interview with Robert Hinckley, General Counsel, NEC Electronics, Mountain View, California (Apr. 25, 1984); telephone interview with Doug Horan, Design Engineer, Intel Corp., Santa Clara, California (Apr. 23, 1984).

25. *1979 House Hearing, supra* note 19, at 64 (testimony of Alan MacPherson, Patent Counsel, Fairchild Camera & Instrumental Corp.).

26. Different styles of chips enjoy different lifetimes. There are three basic chip types: controller chips, microprocessor chips, and memory chips. Memory chips, the least complicated of the three types, also possess the shortest lifetime, five to seven years. For example, in 1976, the 64k bit chip represented state-of-the-art technology. Eight years later in 1984, a one million bit memory chip entered the market. Controller chips, the most sophisticated of the three chips, enter data into and access information stored within memory chips. They, as their name implies, control the functions of other chips. The controller chips presently possess a lifespan of 10-12 years. Microprocessors perform instructions received from memory chips at the direction of the controller chip and enjoy a lifespan in between that of the other chips. Interview with Ron Yin, Patent Attorney, Limbach, Limbach & Sutton, San Francisco, California (Apr. 5, 1984).

sign remains speculative, the costs of such an extension seem to be less uncertain. Obviously, restrictions on copying reduce the sources of supply for chip consumers. In addition, the existence, or potential existence, of copiers prevents pricing at monopolistic levels.[27] Furthermore, the ability to access new technological advances may explain the semiconductor industry's history of continued innovation.

> The most important feature of [the semiconductor] industry is its rapid rate of innovation and technological change. Although it has a high rate of expenditures on research and development, those expenditures can only partly explain the rapid rate of innovation. Other features that seem equally or more important are the use of second sourcing [copying], the mobility of technical personnel, and the relatively low cost and ease of entry into the industry. The fact that companies can rapidly copy each other is very important.[28]

Nevertheless, Congress rejected the concerns discussed above and passed the Chip Act, which extends sui generis protection, based on copyright principles, to semiconductor chips. Considering the concerns noted above, however, two questions arise with regard to the passage of this legislation. First, assuming semiconductors need relief from pirate copying, why are existing intellectual property schemes inadequate for protecting them? Second, do existing intellectual property schemes effectively balance the need for protection of semiconductor design with the need for free accessibility of ideas?

IV. THE TYPE OF PROTECTION REQUIRED

Ideally, a protection scheme for semiconductor chips would encompass the following elements. First, to safeguard the chip manufacturer's investment in innovation, a protection scheme should extend immediately and provide national uniformity. Second, a protection scheme should not last so long as to prevent access to the protected design once the innovator's investment has been recouped. Finally, while protecting the innovator's specific design, a protection scheme must permit competitors to analyze that design and incorporate design "concepts" into their own products.

As discussed in Section III of this Article, timing is critical in protecting chip design. Photolithographic copying erodes the advantage of

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27. For a concise discussion of price theory, see L. SULLIVAN, HANDBOOK OF THE LAW OF ANTITRUST, app. A at 797-806 (1977). *See also 1979 House Hearing*, *supra* note 19, at 51 (testimony of John Finch, Vice President, General Manager, Semiconductor Products, National Semiconductor Corp.) stating: "It is the consumer who has benefited from the competition in the semiconductor field. There has been a dramatic and continuing *decrease in prices* with increased performance." (Emphasis added.)

28. *1979 House Hearing*, *supra* note 19, at 54 (statement of John Finch, Vice President, General Manager, Semiconductor Products, National Semiconductor Corp.).

being first. Although the chip originator may invest years of time before introducing the chip into the market, only a few short months after entry, chip copies may appear.[29] Consequently, protection must extend immediately to safeguard innovative investment.

Semiconductor manufacturers compete in an international market. Thus, at a minimum, any protection extended to their products must possess national uniformity. A variety of conflicting state laws creates confusion over the nature of protection available. Accordingly, state law cannot effectively regulate the promotion and protection of innovation. Federal regulation is needed.

Although protection must be extended immediately, it need not last long, because chips possess relatively short lifespans.[30] Protection intended to return innovative investment need not extend beyond product lifespan; indeed, protections should expire before the product's utility does. Moreover, protection of "lead time" alone may sufficiently safeguard innovative investment because "[i]t is in the first several years of the existence of the product that protection is necessary. The producer has a lead, and it is that lead that must be protected."[31] The need for protection limited in duration becomes even more apparent when learning curve efficiencies are considered.[32]

Even those advocating semiconductor protection acknowledge the need to preserve the competitiveness which has characterized the industry. Competitors must have access to creative design ideas if industry-wide innovation is to continue.[33] Because exact copying by pirates is the industry's primary concern, some freedom to analyze protected semiconductors and incorporate innovative design "concepts" into competing products appears to be appropriate. Thus, a protection scheme should not inhibit the interchange of ideas within the industry.

This Section examines and evaluates the four intellectual property law schemes available for protecting semiconductor chips: unfair competition, trade secret, patent, and copyright. It concludes that copyright

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29. *See supra* note 12 and accompanying text.

30. *See supra* note 26.

31. *1979 House Hearing, supra* note 19, at 41 (testimony of Andrew S. Grove, President, Intel Corp.).

32. *See supra* notes 20-23 and accompanying text.

33. In discussing the Semiconductor Chip Protection Act of 1983, many industry representatives focused upon the need for reverse engineering provisions which would allow competitors to analyze protected chips and incorporate innovative design concepts into their own chips. *See 1983 Senate Hearing, supra* note 5, at 65-66, 82-84, 96, 114 (testimony of F. Thomas Dunlap, Jr., Corp. Counsel and Secretary, Intel Corp.; testimony of Richard Stern, Copyright Counsel for Intel and the Semiconductor Industry Association; letter from Robert C. Hinckley, General Counsel, NEC Electronics; and letter from Gerald J. Massinghoff, Assistant Secretary and Commissioner of Patents and Trademarks).

law best balances the values of promoting competition and protecting innovation.

A. UNFAIR COMPETITION

The law of unfair competition (also known as the law of unfair trade practices) embraces a variety of protections available for business interests which are threatened by unethical competitive behavior. This common law doctrine prohibits such diverse practices as interference with precontractual[34] and contractual[35] relations; infringement of trademark or tradename;[36] false advertisement;[37] misrepresentation;[38] and "passing off" (a practice by which a consumer is intentionally confused as to the source of goods).[39]

None of these protections address the piracy problems plaguing the semiconductor industry.[40] Generally, pirates openly advertise and sell their products as copies. They may even identify their copies with their own distinctive trademark. Consumers knowingly purchase pirated goods, seeking the discounted price associated with their copied status.[41] The unfair practice of concern in this scenario is the pirate's appropriation of the originator's efforts.

In *International News Services v. Associated Press,*[42] the United States Supreme Court announced general common law principles prohibiting appropriation of the fruits of another's investment of

34. *See* Manufacturing Research Corp. v. Greenlee Tool Co., 693 F.2d 1037 (11th Cir. 1982).

35. *See* Mohawk Maintenance Co. v. Kessler, 52 N.Y.2d 276, 419 N.E.2d 324, 437 N.Y.S.2d 646 (1981).

36. *See* Southern v. How, 79 Eng. Rep. 1243 (1619).

37. Skil Corp. v. Rockwell Int'l Corp., 375 F. Supp. 777 (N.D. Ill. 1974); American Home Prod. Corp. v. Johnson & Johnson, 436 F. Supp. 785 (S.D. N.Y. 1977), *aff'd*, 577 F.2d 160 (2d Cir. 1978).

38. Ultramares Corp. v. Touche, Niven & Co., 255 N.Y. 170, 174 N.E. 441 (1931).

39. Mosler Safe Co. v. Ely-Norris Safe Co., 273 U.S. 132 (1927).

40. To some extent, federal legislation has superseded state unfair competition law. The Trademark (Lanham) Act of 1946, Pub. L. No. 79-489, 60 Stat. 427 (codified at 15 U.S.C. §§ 1051-1127 (1976)), offers trademarks and tradename protection. 15 U.S.C. § 1052 (1976). The Lanham Act also prohibits false descriptions and false designations,of origin. 15 U.S.C. § 1125 (1976). The federal statute, however, suffers from the same infirmities as state unfair competition law in addressing the concerns of the semiconductor industry.

41. A clever semiconductor manufacturer might attempt to trademark an entire chip design, rather than an unassociated identifying symbol. Trademark protection, however, has been consistently denied for functional features without secondary meaning, i.e., features that acquire identifying characteristics beyond their utilitarian purpose, for example, a distinctive bottle design. Haig & Haig Ltd., 118 U.S.P.Q. 229 (Dec. Comm'r of Pat. 1958). Trademark protection has also been denied for functional features with secondary meaning. *See In re* Deister Concentrator Co., 289 F.2d 496 (C.C.P.A. 1961). *See also* Fotomat Corp. v. Photo Drive-Thru, Inc., 425 F. Supp. 693 (1977).

42. 248 U.S. 215 (1918).

money, time, and intellectual effort. The Associated Press (AP), a cooperative organization of newspaper representatives, gathered, collated, and organized news for its members. Members, in addition to contributing their own articles, paid a membership fee for the use of articles written by other members. International News Service (INS) was a competing news organization.

AP brought suit to enjoin INS's practice of taking AP news articles from bulletin boards or AP newspapers and then either copying those articles verbatim or rewriting those articles for use by INS members. INS did not attempt to "pass off" its articles as having been written by AP, but engaged in a converse practice. "[I]nstead of selling its own goods as those of [AP], it substitute[d] misappropriation in the place of misrepresentation, and [sold AP's] goods as its own."[43] AP's articles were not copyrighted, thus AP could not prevent competitors from copying its articles. Nevertheless, the Court considered AP's investment of time, effort, and money as "quasi-property."[44] AP's quasi-property right entitled it to a limited remedy which did not prohibit copying, "but only postpone[d] participation by complainant's competitor in the processes of distribution and reproduction of news that it [had] not gathered, and only to the extent necessary to prevent that competitor from reaping the fruits of complainant's efforts and expenditure . . . ."[45] Although the misappropriation doctrine might provide some protection for semiconductor chip creators, the ambiguities in the doctrine require moderation in its application. As Justice Brandeis stated in his dissent in *International News Service*:

> [T]he fact that a product of the mind has cost its producer money and labor, and has a value for which others are willing to pay, is not sufficient to ensure to it this legal attribute of property. The general rule of law is, that the noblest of human productions—knowledge, truths ascertained, conceptions, and ideas—become, after voluntary communications to others, free as the air to common use.[46]

Moreover, the misappropriation doctrine suffers from the same lack of uniformity afflicting all common law protection schemes.[47] This doctrinal flaw led the National Commission on New Technological Uses

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43. *Id.* at 242.

44. *Id.*

45. *Id.* at 241.

46. *Id.* at 250.

47. In *International News Service*, the Supreme Court announced principles of general federal common law. Such principles, articulated by the federal courts, could have generated much needed uniformity. The Court, however, announced in 1938: "There is no federal general common law." Erie R. R. Co. v. Tompkins, 304 U.S. 64, 78 (1938). Nevertheless some federal common law still exists. *See* Clearfield Trust Co. v. United States, 318 U.S. 363 (1943), which provides that federal common law is appropriate only in few and restricted instances. *See also* C. WRIGHT, LAW OF FEDERAL COURTS § 60 (4th ed.

of Copyrighted Works (CONTU) to reject state misappropriation law as a viable means of protecting computer programs: "Although unfair competition [of the misappropriation variety] may provide relief ancillary to copyright in certain situations, its scope is not as broad, and it seems unlikely that it alone could provide sufficient protection . . . ."[48]

Most importantly, the sweep of state misappropriation law was severely curtailed by the decisions of the Supreme Court in two companion cases, *Sears, Roebuck & Co. v. Stiffel Co.*[49] and *Compco Corp. v. Day-Brite Lighting, Inc.*[50] In both cases the plaintiffs produced lamps whose popularity spurred the manufacture of substantially similar products by competitors. Patents held on the plaintiffs' lamp designs were found to be invalid,[51] forcing the plaintiffs to rely upon state law for protection.

The plaintiff in *Sears* claimed that the defendant's sales of lamps, which were "confusingly similar" to plaintiff's lamps, violated state unfair competition law which prohibited design misappropriation.[52] The critical question in *Sears* became "whether a State's unfair competition law can, consistently with the federal patent laws, impose liability for or prohibit the copying of an article that is protected by neither a federal patent nor a copyright."[53]

The Court's answer was "no." The Court held that the need for uniform patent policy outweighed state interests. The Court stated:

> [T]he patent system is one in which uniform federal standards are carefully used to promote invention while at the same time preserving free competition. Obviously a State could not, consistently with the Supremacy Clause of the Constitution, extend the life of a patent beyond its expiration date or give a patent for an article which lacked the level of invention required for federal patents. To do either would run counter to the policy of Congress of granting patents only to true inventions, and then only for a limited time. Just as a State cannot encroach upon the federal patent laws directly, it cannot, under some other law, such as that forbidding unfair competition, give protection of a kind that clashes with the objectives of the federal patent laws.[54]

In finding that federal patent policy preempted state unfair competition concerns, the Court further stated:

> To allow a State by use of its law of unfair competition to prevent the

1983). Based on the foregoing, federal common law is an unlikely source of unifying principles of protection.

48. NATIONAL COMM'N ON NEW TECHNOLOGICAL USES OF COPYRIGHTED WORKS, FINAL REPORT 18 (1979) [hereinafter CONTU FINAL REPORT].

49. 376 U.S. 225 (1964).

50. 376 U.S. 234 (1964).

51. *Sears*, 376 U.S. at 226-27; *Compco*, 376 U.S. at 236 n.2.

52. *Sears*, 376 U.S. at 225-26.

53. *Id.* at 225.

54. *Id.* at 230-31.

> copying of an article which represents too slight an advance to be patented would be to permit the State to block off from the public something which federal law has said belongs to the public.[55]

Although the *Sears* and *Compco* decisions seemed to foreclose state efforts to extend protections to articles within the purview of the federal copyright and patent laws, the Court retreated from its bright line approach in *Goldstein v. California*.[56] In *Goldstein*, "pirates" obtained popular tapes and records and subsequently copied the originals onto blank tapes. These copies were sold without authorization from either the original performing artists or the recording companies. While federal copyright law protected neither group,[57] California law prohibited such piracy.[58]

Although the decisions in *Sears* and *Compco* seemed to indicate that California's law was invalid, the *Goldstein* Court did not so hold. Instead, it construed the *Sears* and *Compco* decisions to pertain only to the preemption of state unfair competition law by federal patent law.[59] The Court noted that the scope of "writings"[60] in the Copyright Act was not coextensive with the term "writings" in the Constitution.[61] The Court further found that in the area of copyright, at least where musical recordings were concerned, federal law did not preempt state action:

> No comparable conflict between state law and federal law arises in the case of recordings of musical performances. In regard to this category of "Writings," Congress has drawn no balance; rather, it has left the area unattended, and no reason exists why the State should not be free to act.[62]

Still, the basis for the Court's restrictive reading of its *Sears* and *Compco* decisions remains unclear.[63]

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55. *Id.* at 231-32. *Accord Compco*, 376 U.S. at 237.

56. 412 U.S. 546 (1973).

57. 17 U.S.C. §§ 1-216 (1970). Federal copyright laws were amended in 1971 to protect recordings "fixed, published, and copyrighted" on and after February 15, 1972 and before January 1, 1975. Pub. L. No. 92-140, 85 Stat. 391 (1971) (codified as amended at scattered sections of 17 U.S.C.). The recordings copied in *Goldstein* were made before February 15, 1972.

58. CAL. PENAL CODE § 653(h) (West 1970).

59. *Goldstein*, 412 U.S. at 569-70.

60. "The works for which copyright may be secured under this title shall include all the writings of an author." 17 U.S.C. § 4 (1970).

61. "To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries." U.S. CONST. art. I, § 8, cl. 8. *See also infra* notes 164-74 and accompanying text.

62. *Goldstein*, 412 U.S. at 569-70.

63. One commentator has argued that the *Goldstein* decision might be explained if distinctions between published and unpublished works are made. Under this view, states are given power with respect to the latter group. Because the federal legislation addressed only published works, it did not preempt state action regarding unpublished

However one construes the decision in *Goldstein* and its apparent modification of the language in the *Sears* and *Compco* decisions, effectiveness of state law provisions in protecting semiconductors remains doubtful. The United States Copyright Office has essentially denied copyright protection for semiconductor chips, maintaining that, as utilitarian articles, chips must be protected under the patent laws.[64] Thus, state enacted copyright or unfair competition laws[65] protecting semiconductors directly conflict with the federal patent system much as in the *Sears* and *Compco* decisions.[66] Finally, state misappropriation doctrine lacks the national uniformity necessary for effective semiconductor design protection. Thus, the law of unfair competition provides little protection for semiconductor chips.

B. TRADE SECRET

Trade secret law developed as an offshoot of unfair competition

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works. As this author acknowledges, however, the Court did not clearly articulate its reasoning. Thus, the Court's basis for distinguishing *Goldstein* from *Sears* and *Compco* remains unclear. *See* Brown, *Publication and Preemption in Copyright Law: Elegiac Reflections on Goldstein v. California*, 22 UCLA L. REV. 1022 (1975).

Many of the questions raised by the Court's decision dissipated with the passage of the Copyright Act of 1976, Pub. L. No. 94-553, 90 Stat. 2541 (codified at scattered sections of 17 U.S.C. (1982)). With that Act, Congress changed the basic structure of American copyright law. E. KITCH AND M. PERLMAN, LEGAL REGULATION OF THE COMPETITIVE PROCESS 622 (2d ed. 1979). Under that Act, copyright law assumed many of the properties of the misappropriation doctrine as announced in *International News Service*. *Id.* Furthermore, that Act largely extinguished the distinctions between published and unpublished works. *Id.* at 623-24. Federal copyright protection automatically arises for "original works of authorship fixed in any tangible medium of expression . . . ." 17 U.S.C. § 102(a) (1982).

Moreover, in an effort to create a unitary federal statutory system of copyright, various rights and remedies established under state law were preempted by the Act. *See* 17 U.S.C. § 301 (1982). In enacting § 301, Congress intended to "preempt and abolish any rights under the common law or statutes of a State that are equivalent to copyright and that extend to works coming within the scope of Federal copyright law." H.R. REP. NO. 1476, 94th Cong., 2d Sess. 130 (1976), *reprinted in* 1976 U.S. CODE CONG. & ADMIN. NEWS 5659, 5746. Thus, in an action for copyright infringement and for unfair competition based on alleged similarity between two "superhero" characters, the court held that although not all state unfair competition claims concerning works of scholarship are preempted by federal copyright law, the federal law preempts state claims that "rely on misappropriation branch" of unfair competition law. Warner Bros., Inc. v. ABC, 720 F.2d 231, 247 (2d Cir. 1983).

64. *See 1983 Senate Hearing*, *supra* note 5, at 27-36 (statement of Dorothy Schrader, Associate Register of Copyrights for Legal Affairs and General Counsel of the Copyright Office). *See also infra* Section V(A).

65. *Goldstein* would appear to raise the possibility that *some* state unfair competition laws might not conflict with federal policy, at least in areas affording copyright-like protections.

66. *But see* Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470 (1974), discussed *infra* in text accompanying notes 78-100.

law.[67] As stated in the *Restatement of Torts*:

> A trade secret may consist of any formula, pattern, device or compilation of information which is used in one's business, and which gives him an opportunity to obtain an advantage over competitors who do not know or use it. It may be a formula for a chemical compound, a process of manufacturing, treating or preserving materials, a pattern for a machine or other device, or a list of customers.[68]

A diverse range of theories supporting trade secret protection exists. "In some cases it has been referred to property, in others to contract, and in others, again, it has been treated as founded upon trust or confidence . . . ."[69] Whatever the basis of trade secret protection, one element remains critical: secrecy.

Protection depends upon secrecy. Public disclosure of an idea by the originator renders the idea public property.[70] Complete secrecy is generally not necessary; the majority of cases require "relative secrecy" or a "substantial element of secrecy."[71] Moreover, secrecy is not lost if the holder of the trade secret reveals the secret to another "in confidence and under an implied obligation not to use or disclose it."[72] The subject of the trade secret, however, cannot "be of public knowledge or of a general knowledge in the trade or business."[73] Although it need not possess novelty in the patent sense, some minimum level of novelty is required for trade secret protection.[74]

Trade secret protection prevents "disclosure or unauthorized use of the trade secret by those to whom the secret has been confided under express or implied restriction of nondisclosure or nonuse."[75] Trade se-

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67. Stern, *A Re-examination of Pre-emption of State Trade Secret Law After Kewanee*, 42 GEO. WASH. L. REV. 927, 937 (1974). The two cases of Peabody v. Norfolk, 98 Mass. 452 (1868) and Cincinnati Bell Foundry Co. v. Dodds, 19 Ohio Weekly Law Bull. 84 (Super. Ct. Cin. 1887) formed the basis for development of American trade secret law. E. KITCH & M. PERLMAN, *supra* note 63, at 532-33.

68. RESTATEMENT OF TORTS § 757 comment b (1934).

69. Morrison v. Moat, 68 Eng. Rep. 492 (1851).

70. *See* CONTU FINAL REPORT, *supra* note 48, at 17. *Compare* E.I. duPont de Nemours & Co., Inc. v. Christopher, 431 F.2d 1012, 1015-16 (5th Cir. 1970), *cert. denied*, 400 U.S. 1024 (1971) ("To obtain knowledge of a process without spending the time and money to discover it independently is *improper* unless the holder voluntarily discloses it or fails to take reasonable precautions to ensure its secrecy.").

71. K-2 Ski Co. v. Head Ski Co., Inc., 506 F.2d 471, 474 (9th Cir. 1974).

72. Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 475 (1974).

73. *Id.* at 475.

74. *Id.* at 476. *See also*, Comment, *The Stiffel Doctrine and the Law of Trade Secrets*, 62 N.W. U.L. REV. 956, 969 (1968); A. O. Smith Corp. v. Petroleum Iron Works, Co., 73 F.2d 531, 538 (6th Cir. 1934) (Patent laws require "invention," while trade secret laws require only "discovery" for protection.).

75. *Kewanee Oil*, 416 U.S. at 475. *See also* RESTATEMENT OF TORTS § 757 comment a (1939).

cret law also protects the trade secret holder from disclosure or use where the secret is obtained through improper means such as theft, wiretapping, or aerial reconnaissance.[76] Trade secret law does not, however, "offer protection against discovery by fair and honest means, such as by independent invention, accidental disclosure, or by so-called reverse engineering, that is by starting with the known product and working backward to divine the process which aided in its development or manufacture."[77] Accordingly, trade secret liability arises when a general duty of good faith provided for by contract, confidence, or propriety is breached.

Not surprisingly, the *Sears* and *Compco* decisions raised the spectre of federal preemption of state trade secret law. The Supreme Court addressed this area of potential conflict in *Kewanee Oil Co. v. Bicron Corp.*[78] In *Kewanee,* the Harshaw Chemical Co., an unincorporated division of Kewanee Oil Co., had developed a successful process for growing crystals used in detecting ionizing radiation. To protect its secret processing method, Harshaw required its employees to sign agreements not to disclose trade secrets obtained as Harshaw employees. Several employees then left Harshaw to join Bicron Corp., a competitor. Kewanee brought suit to enjoin Bicron from using Kewanee's trade secrets.

The district court, applying Ohio trade secret law,[79] granted a permanent injunction. The court of appeals reversed, finding that Ohio's trade secret law conflicted with the federal patent laws. The United States Supreme Court reversed the denial of injunctive relief.

The Court began by determining whether the states were prohibited from providing trade secret protection for intellectual property. Relying upon its analysis in *Goldstein,*[80] the Court declared: "Just as the States may exercise regulatory power over writings so may the States regulate with respect to discoveries."[81] As with copyrights, the only limitation on the states in regulating the area of patents is that state laws "do not conflict with the operation of the laws in this area

76. *Kewanee Oil,* 416 U.S. at 475-76. *Accord* E.I. duPont de Nemours & Co. Inc. v. Christopher, 431 F.2d 1012, 1015-16 (5th Cir. 1970).

77. *Kewanee Oil,* 416 U.S. at 476.

78. 416 U.S. at 470. For an excellent critique of the Supreme Court's decision and presentation of an alternative analysis for preemption in this area, see Stern, *supra* note 67, at 927.

79. "No person, having obtained possession of an article representing a trade secret or access thereto with the owner's consent, shall convert such article to his own use or that of another person, or thereafter without the owner's consent make or cause to be made a copy of such article, or exhibit such article to another." OHIO REV. CODE ANN. § 1333.51(c) (Anderson 1973).

80. Goldstein v. California, 412 U.S. 546 (1973).

81. *Kewanee Oil,* 416 U.S. at 479.

passed by Congress . . . ."[82] The Court then considered the purposes of the patent laws and those of the state trade secret laws.

The Court noted two related policies within the patent laws. First, the patent laws "promote the Progress of Science and useful Arts"[83] by offering a limited monopoly to encourage innovative activity. The results of that activity benefit all of society. To benefit society, inventive ideas must be disclosed to the public. State action cannot interfere with this second patent policy of disclosure.[84]

The Court found that "[t]he maintenance of standards of commercial ethics and the encouragement of invention"[85] served as broad policies underlying state trade secret law. The Court noted that the first policy preserved the "life and spirit of the commercial world."[86] With respect to the second policy, the Court noted that trade secret law subsidized research and development thereby increasing "economic efficiency within large companies through the dispersion of responsibilities for creative developments."[87] Having articulated the policies of the state and federal laws, the Court then moved to an examination of the interaction between the two systems.

Only processes, machines, manufactures, compositions of matter, and improvements qualify as patentable subject matter. Discoveries outside of those categories could not be patented, and the holder of such discoveries would have no incentive to apply for a patent. Thus, abolition of trade secret protection would not increase disclosure with respect to such articles as customer lists.[88]

The Court also saw no need for preemption of trade secret law protections for novel, useful inventions meriting patent protection. Invention would still be encouraged. The "existence of another form of incentive to invention" would not discourage invention.[89] There could be no conflict. Moreover, the policy, that matter once in the public domain must remain there, was not incompatible with the trade secret law because a trade secret, by definition, remains outside of the public domain.[90]

Reconciling the disclosure policy of patent law with trade secret protection presented a more difficult problem for the Court. The Court employed a three-part analysis, and considered preemption with respect

82. *Id.*
83. U.S. CONST. art. I, § 8, cl. 8.
84. *Kewanee Oil*, 416 U.S. at 480-81.
85. *Id.* at 481.
86. *Id.* at 481-82.
87. *Id.* at 482.
88. *Id.* at 483.
89. *Id.* at 484.
90. *Id.*

to inventions that are: (1) unpatentable, (2) of questionable patentability, and (3) patentable.[91]

For the first category of inventions, those which are unpatentable, preemption would not facilitate disclosure because patent protection, by definition, is unavailable. Trade secret law, however, could still benefit society by "encouraging invention in areas where patent law does not reach" and thereby affording the public "the use of a valuable, if not quite patentable, invention."[92] Preemption of trade secret law might spur industry use of "self-help" techniques such as security precautions and higher salaries for employees. Besides raising costs to the public, such measures would place smaller companies at a distinct disadvantage. In addition, preemption might reduce trade secret licensing as companies become less willing to reveal their secrets to others. The corresponding blockage of technology dissemination would result in economic waste and unnecessary misallocation of resources.[93]

With respect to items of questionable patentability, the Court asserted that "the potential rewards of patent protection are so far superior to those accruing to holders of trade secrets, that the holders of such inventions will seek patent protection, ignoring the trade secret route."[94] For inventions on the edge of the two systems, preemption might cause their inventors to apply for patents. Some of these inventors would be denied protection and no impact on disclosure would result. Far greater problems would occur with the issuance of invalid patents because this would unnecessarily impede the free use of ideas. The Court believed that invalid patents would issue with increasing frequency and thus outweigh any possible benefits to be accrued from increased disclosure.[95]

With respect to inventions which are clearly patentable, the Court stated that the "federal interest in disclosure is at its peak" and that "[i]f a State, through a system of protection, were to cause a substantial risk that holders of patentable inventions would not seek patents, but rather would rely on the state protection, we would be compelled to hold that such a system could not constitutionally continue to exist."[96] But the Court held that trade secret law poses no such threat to the patent system because the state laws offer far weaker protection than that available to the patent holder. The Court therefore concluded that "[s]tates should be free to grant protection to trade secrets."[97]

91. *Id.*
92. *Id.* at 485.
93. *Id.* at 486.
94. *Id.* at 487-88.
95. *Id.* at 488-89.
96. *Id.* at 489.
97. *Id.* at 493.

Even if trade secret protection is not preempted by the federal patent laws, it supplies little protection for the semiconductor industry. Although mask works and semiconductor chips which serve as patterns for a machine or other devices do constitute protectable subject matter,[98] for the most part, pirates do not engage in the breaches of good faith that trigger trade secret liability.[99] Pirates commit the act of misappropriation when they purchase semiconductors, which are sold to the public, disassemble the devices, photograph the exposed layers, and duplicate the mask works for manufacture.[100] This process seems to constitute "reverse-engineering," a practice which is not prohibited by trade secret law.[101]

Although trade secret law may not protect against the creation of mask works by pirates, it may prevent disclosure of manufacturing processes. As processing technologies become more complex, manufacturers may choose to create even more individualized production methods than those currently used to protect their creations. Indeed, chip manufacturers may choose to engage in more expensive processes simply out of protection concerns. Of course, to ensure effective trade secret protection, exchange between manufacturers must be minimized. Despite the Court's pronouncements in *Kewanee Oil,* concerns regarding increased user costs and reduced information flow led CONTU to reject trade secret law as an effective means of computer program protection. In addition, CONTU expressed concern that trade secrecy would result in unnecessary duplication of efforts by manufacturers.[102]

In sum, trade secret law offers ineffective protection for the semiconductor industry. The doctrine lacks national uniformity, decreases information dissemination within the industry, may increase user costs, and may protect innovation beyond the time necessary to recoup investment expenses.

In consideration of the foregoing, some scheme offering an alternative to the choices of patent protection or no protection at all still seems to be warranted. Such a scheme should encourage innovation by affording limited safeguards against appropriation of innovative efforts. The desire to protect against the appropriation of innovative efforts seemed to underlie the Supreme Court's approval of trade secret protection for unpatentable items in *Kewanee Oil.*[103] Nevertheless, replacement of trade secret law with some form of "misappropriation law" for inven-

98. RESTATEMENT OF TORTS § 757 comment b (1939). *See supra* text accompanying note 68.

99. *See supra* text accompanying notes 75-76.

100. *See supra* text accompanying notes 7-11.

101. *See supra* text accompanying note 77.

102. CONTU FINAL REPORT, *supra* note 48, at 17-18.

103. As the Court observed, trade secret law could benefit society by encouraging "in-

tions demonstrating a minimum level of inventiveness is warranted because trade secret law requires restricted disclosure of innovative ideas which itself may discourage innovation.[104] The desirability of adding such protection, and the resulting classification burdens, is discussed in Section VI of this Article.

C. PATENT PROTECTION

1. *An Introduction to Patent Law*

The United States Constitution authorizes Congress "[t]o promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors, the exclusive Rights to their respective Writings and Discoveries."[105] Accordingly, patent law rewards inventors by granting them an exclusive right to make, use, or sell their discoveries to the absolute exclusion of others.[106] The power granted by a patent endures for only seventeen years[107] and cannot be renewed. After expiration, the discoveries enter the public domain.[108]

Only processes, machines, manufactures, compositions of material, or improvements of material qualify for patent protection. To merit the preclusive power provided by a patent, a discovery must be novel, useful, and nonobvious to one skilled in the art.[109] Further, the discovery must be sufficiently disclosed to permit one skilled in the art to make the use of the invention.[110] Of these requirements, novelty and nonobviousness pose the greatest obstacles to creators seeking patent protection.

2. *The Patenting Process*

To obtain a patent, an inventor must submit an application to the U.S. Patent Office. The application must contain an explanation of how the invention works, a drawing of the item to be patented, an oath that

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vention in areas where patent law does not reach" and thereby afford the public "the use of valuable, if not quite patenable, invention." *Kewanee Oil*, 416 U.S. at 485.

104. *See generally* Kaplow, *The Patent-Antitrust Intersection: A Reappraisal*, 97 HARV. L. REV. 1815 (1984). (Professor Kaplow, in a review of the conflict between the antitrust and patent laws, focuses upon the relationship between the reward a patentee receives and the value of the patent. He proposes a system in which innovations displaying different levels of inventiveness and social value would be rewarded accordingly. Nothing would, theoretically at least, necessitate restriction of operation of such a system to articles displaying novelty and nonobviousness, the hallmarks of patent protection.)

105. U.S. CONST. art. I, § 8, cl. 8.

106. 35 U.S.C. § 154 (Supp. I 1983).

107. *Id.*

108. 35 U.S.C. § 101 (1982).

109. *Id.* §§ 101-103.

110. *Id.* § 112.

the invention is the inventor's, and a description of the claims that entitle the invention to patent protection.[111]

The Patent Office examines the application, searches past patents and relevant technical literature, and determines whether the invention displays the characteristics required by the patent laws.[112] The Patent Office may deny patentability to some or all of the claims. In response, the application may be revised to meet the examiner's objections or the applicant may explain why the examiner is mistaken and resubmit the application.[113] If another applicant makes similar or identical claims, the Patent Office must commence an interference proceeding to determine which applicant first conceived and reduced the invention to practice.[114] The examination process takes two to five years.[115] Eventually, a patent may issue, granting the patentee the exclusive right to make, use, or sell the invention to the absolute exclusion of others for the life of the patent. Because lead time is of critical importance in a rapidly changing market, the time factor is a major factor against patents as an effective means of protecting semiconductor products.

3. *Patent Protection for Semiconductors*

Little concern exists over the subject matter requirements of patent law as they apply to semiconductors. The mask works, processes used to manufacture semiconductors, and the chips themselves qualify as patentable subject matter.[116]

Under patent law, a "process" is a mode of treating certain materials to produce a given result. It is an act, or a series of acts, performed upon the subject matter to be transformed and reduced to a different state or thing.[117] Accordingly, patent law should be available to protect the manufacturing methods used to produce semiconductors because these methods fall within the definition of a "process."

Patent law also affords protection for machines. A "machine" has been defined as a "concrete or tangible thing consisting of parts or of certain devices and combinations of devices."[118] As discussed previously

111. *Id.* §§ 111-113, 115.

112. *Id.* § 131.

113. *Id.* § 132.

114. *Id.* § 135.

115. 175 U.S.P.S. VIII (1973).

116. For a thorough treatment of this area, see Oxman, *Intellectual Property Protection and Integrated Circuit Masks*, 29 COPYRIGHT L. SYMP. (ASCAP) 165 (1983).

117. Cochrane v. Deener, 94 U.S. 780 (1876). *See also* Corning v. Burden, 56 U.S. (15 How.) 252, 267 (1853) (the Court stated, "[W]here the result or effect is produced by chemical action, by the operation or application of some element or power of nature, or of one substance to another, such modes, methods, or operations are called processes.").

118. *See* 1 WALKER ON PATENTS 136 (E. Lipscomb ed. 1984) [hereinafter WALKER]; *In re* Freeman, 573 F.2d 1237 (C.C.P.A. 1978); *In re* Bernhart, 417 F.2d 1395 (C.C.P.A. 1969).

in this Article, semiconductor chips are integrated circuits, sophisticated electrical devices chemically formed in silicon.[119] Therefore, semiconductor chips ought to qualify as patentable machines.[120]

The terms "manufactures" is a catch-all category in patent law, embracing "whatever is made by the art of industry or man but excluding processes, machines, and compositions of matter. . . . It has been given a very comprehensive interpretation but not so universal as to include other subjects or classes of inventions authorized by the patent statutes."[121] A newly manufactured article must require the exercise of invention or discovery beyond that necessary to create the apparatus that produced the article.[122] Therefore, under this definition, masks might acquire patent protection.

As technology advances, however, patent protection of masks and mask works becomes less desirable. Mask works are no longer necessary to generate semiconductor chips.[123] Protection of the mask no longer ensures protection of the ultimate product: the semiconductor chip. Hence, manufacturers eager to safeguard their inventions perceive process or machine patenting as the most attractive means for protecting semiconductor chips under patent law.

Whatever the invention, machine, manufacture, or process, no patent will issue unless the statutory requirements of novelty, utility, and nonobviousness have been met.[124] The patent clause itself authorizes Congress "[t]o promote the *useful* Arts."[125] In light of that constitutional command, the Patent Act extends protections only to "useful" inventions.[126] Utility cannot be presumed; it is an essential part of patent specification.[127] Without a requirement of utility, an inventor could monopolize an area of unknown scope.[128] Such a broad monopoly might constitute control of an idea, which cannot be patented.[129]

Utility concerns frequently arise when process patents are sought.[130] In denying a patent for a process usable only in pure research, the Supreme Court in *Brenner v. Manson* declared: "Unless and

119. *See supra* text accompanying notes 2-6.

120. Oxman, *supra* note 116, at 190-91.

121. WALKER, *supra* note 118, at 139.

122. Oxman, *supra* note 116, at 191.

123. *See supra* note 8.

124. 35 U.S.C. §§ 101-103 (1982).

125. U.S. CONST. art. I, § 8, cl. 8 (emphasis added).

126. 35 U.S.C. § 101 (1982).

127. *Id.* § 112.

128. Brenner v. Manson, 383 U.S. 519, 534 (1966).

129. Gottschalk v. Benson, 409 U.S. 63, 71-72 (1972). *See also* Le Roy v. Tatham, 55 U.S. (14 How.) 155, 174 (1852) (The court stated that "[a]n idea of itself is not patentable.").

130. *See, e.g., Gottschalk*, 409 U.S. at 63; *Brenner*, 383 U.S. at 519; *Le Roy*, 55 U.S. at 155.

until a process is refined and developed to this point—where specific benefit exists in currently available form—there is insufficient justification for permitting an applicant to engross what may prove to be a broad field."[131] There are no such concerns in the chip manufacturing process because it creates products with clearly delineated purposes. These products, chips and mask works, if patented, pose no threat of creating a "monopoly of knowledge . . . . blocking off whole areas of scientific development. . . .[132] Consequently, the utility requirement poses no serious obstacle to patenting chips, masks, or manufacturing processes.

Pursuant to section 101 of the Patent Act, only "new" inventions merit the protection of the patent laws.[133] Section 102 defines "novelty" and establishes additional statutory bars to protection.[134] The novelty standard ensures reward for the earliest original inventor. By rewarding the first and original inventor, the patent laws encourage in-

131. 383 U.S. at 534-35.

132. *Id.* at 534.

133. 35 U.S.C. § 101 (1982).

134. *Id.* § 102. Section 102 provides:

A person shall be entitled to a patent unless—

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

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

(c) he has abandoned the invention, or

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

(e) the invention was described in a patent granted on an application for a patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention there of by the applicant for patent, or

(f) he did not himself invent the subject matter sought to be patented, or

(g) before the applicant's invention thereof the invention was made in this country by another who had not abandoned, suppressed, or concealed it. In determining priority of invention there shall be considered not only the respective data of conception and reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce practice, from a time prior to conception by the other.

Id.

vention.[135] The other statutory provisions promote disclosure which benefits society. Thus, the first and original inventor only receives patent protection if that inventor diligently reduces the invention to practice.[136] Further, those who conceal, suppress, or abandon their invention to the detriment of society, abandon their right to patent protection.[137] Closely related to the requirement of novelty is that of nonobviousness.[138]

In 1952, when Congress announced the requirements for patent protection—novelty, utility, and nonobviousness—Congress intended to replace the judicial standard of "inventiveness," which had enjoyed little uniformity in court decisions. In *Graham v. John Deere Co.*,[139] the Supreme Court announced a three-step test for determining obviousness or nonobviousness: "Under § 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."[140] To clarify the nonobviousness inquiry, secondary considerations such as commercial success, long-felt but unsolved needs, and failure of others may also be used.[141] The Court recognized that the section 103 test was a rigorous one when it stated: one

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135. *See* Gayler v. Wilder, 51 U.S. (10 How.) 477 (1850).

136. *See* Gillman v. Stern, 114 F.2d 28 (2d Cir. 1940), *cert. denied*, 311 U.S. 718 (1941).

137. 35 U.S.C. § 102(g) (1982). *See* Ansul Co. v. Uniroyal, Inc., 301 F. Supp. 273 (S.D.N.Y. 1969), *modified*, 448 F.2d 872 (1971), *cert. denied*, 404 U.S. 1018 (1972); Manson v. Hepburn 13 App. D.C. 86 (1898).

138. *See In re* Foster, 343 F.2d 980 (1965), *cert. denied*, 383 U.S. 966 (1966).

139. 383 U.S. 1 (1966).

140. *Id.* at 17.

141. *Id.* at 17-18. *See also* Note, *Subtests of "Nonobviousness": A Nontechnical Approach to Patent Validity*, 112 U. PA. L. REV. 1169 (1964). The Supreme Court's explicit reference to this Note in its *Graham* decision has given this Note unusual significance. Other tests suggested in this Note include: acquiescence by competitors to the validity of the patent; simultaneous solution of the problem solved by the patentee by others (which tends to demonstrate lack of inventiveness); approval of the invention by technologists, scientific commentators, and university professors, and difficulty in obtaining a patent from the patent office (again tending to demonstrate no invention). *Id.* at 1178-82.

These tests have not escaped criticism, however:

> [The] tests make little analytic sense. For instance, the patentee's innovation may have been made possible by some other technological advance, such as the development of a new material or testing procedure, which was not available to others who tried to satisfy the long felt demand. Commercial success may have been due to good timing, changes in consumer markets, or attractive packaging. Commercial acquiescence simply reflects the judgments of competitors that a license or non-infringement is cheaper than litigation, and constitutes a form of hearsay opinion evidence. Simultaneous solution by others may simply show that the problem solved by the invention was widely regarded as important so that many able researchers were put to work on it. Approval by experts is ambiguous because usually not addressed to the technical patent question and constitutes a form of hearsay expert testimony. Difficulties in obtaining a patent from the patent office can result from many things, including an incompetent patent attorney.

"who seeks to build a better mousetrap today has a long path to trek before reaching the patent office."[142]

The dual tests of novelty and nonobviousness almost certainly bar patenting of chips, masks, and manufacturing processes in the semiconductor industry. Semiconductors are not designed in a vacuum; they are designed to meet specific performance criteria. As a result of these similar performance criteria, as well as space and cost constraints, engineers often converage upon similar designs.[143] Indeed, "some circuits are so fundamental that essentially one variation serves the entire industry."[144] As one expert suggests, "A chip may be the product of millions of dollars and thousands of hours of effort, but it is the result of hard work, not 'invention.' "[145]

This is not to say that a revolutionary configuration of known circuits could not qualify as novel and nonobvious.[146] Nor is it to say that a new semiconductor manufacturing process, such as electron bombardment technology, might not possess novelty and nonobviousness. Rather, it is an acknowledgement that advancements in the semiconductor industry rarely display the departure from the prior art necessary for patent protection.[147]

Although requirements for patent protection are rigorous, the rewards are substantial. A patent grants an exclusive monopoly to the inventor for seventeen years. The patent holder may block independent

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> Of all these tests, commercial success is the most troubling because it seems to create a presumption of validity whenever the patented innovation is commercially successful.

E. KITCH & M. PERLMAN, *supra* note 63, at 889-90.

142. 383 U.S. at 19.

143. *1983 Senate Hearing*, *supra* note 5, at 117 (statement of the Patent Task Force, the United States Activities Board, and the Institute of Electrical and Electronic Engineers, Inc.). *But see id.* at 145 (letter of Leslie Valdez, Senior Vice President, Intel Corp.) ("Engineers do not converge on a single most reasonable layout because no such thing exists.").

144. *Id.* at 117 (statement of the Patent Task Force, the United States Activities Board, and the Institute of Electrical and Electronic Engineers, Inc.).

145. Statement of Prof. Arthur Miller, Harvard Law School, presented at the *1983 Senate Hearing*, *supra* note 5, but not included in the Hearing materials, at 6 [hereinafter Miller Statement].

146. *See generally* Sakraida v. Ag Pro Inc., 425 U.S. 273 (1973) ("Nonobviousness" often requires that a combination of known elements display "synergism"—that is, the combination must result in something greater than the sum of its parts.). For a discussion of the semantic nature of the term "synergism," see Palmer v. Orthokinetics, Inc., 611 F.2d 316, 324 n.17 (9th Cir. 1980), in which the court expressed dissatisfaction with the concept.

147. *See* Oxman, *supra* note 116, at 196 (discussing the difficulties in ascertaining the prior art: "[N]one of the prior art is presently recorded or organized in a manner that would make a prospective patentee aware of preemption.").

invention of equivalents.[148] Those who independently reach the same result as the patent holder, unaware of the patent, must acquire the patent holder's permission to use the "discovery." Because patents grant such power, their acquisition must be carefully monitored.

Although the patent laws offer uniform federal intellectual property protection, patents cannot effectively protect the innovation investment of those who create semiconductor chips. The novelty and nonobviousness requirements allow few inventors to obtain patents.[149] Amending the Patent Act to protect inventions exhibiting less "inventiveness" might exceed the scope of the patent clause, which only authorizes Congress "to promote the Progress of Science and useful Arts" by rewarding "Inventors" with exclusive rights to their "Discoveries."[150] Congress could, however, base legislation upon the commerce clause.[151] Nevertheless, considering the preclusive power a patent (or similar protections forged from alternative constitutional provisions) provides its holder, lowering the standards for obtaining a patent without corresponding reductions in patent protection seems unwise. The complications resulting from such restructuring of the patent system would outweigh any potential benefits.

Indeed, in the *1983 Senate Hearings,* semiconductor industry representatives demanded relief from piracy, while uniformly expessing their desire that any chip protection scheme allow reverse-engineering.[152] Without specific provisions allowing reverse-engineering, they argued, industry innovation might decline substantially. Reverse-engineering efforts would be highly speculative because only if those efforts themselves qualify for patent protection could the reverse engineer exploit

148. *1983 Senate Hearing, supra* note 5, at 90 (testimony of Prof. Arthur Miller, Harvard Law School).

149. Even chips which meet the requirements of novelty and nonobviousness may be unpatentable because of the practical difficulties in making a written disclosure of sufficient particularity to notify other inventors of the scope of the protected discovery, as required in section 112 of the Patent Act. *See* Oxman, *supra* note 116, at 197.

150. *See* U.S. CONST. art. I, § 8, cl. 8; Graham v. John Deere Co., 383 U.S. 1, 5-6 (1966) ("The Congress in the exercise of the patent power may not overreach the restraints imposed by the stated constitutional purpose. Nor may it enlarge the patent monopoly without regard to the innovation, advancement or social benefit gained thereby.").

151. *See* U.S. CONST. art. I, § 8, cl. 3; United States v. Darby, 312 U.S. 100 (1941) (the Court recognized Congress' plenary power under the commerce clause). *See also 1983 Senate Hearing, supra* note 5, at 91 (testimony of Prof. Arthur Miller, Harvard Law School) (Little doubt exists that Congress could provide some new form of intellectual property protection under its commerce clause powers.).

152. *1983 Senate Hearing, supra* note 5, at 65, 84-85, 100-01, 114 (testimony of F. Thomas Dunlap, Jr., Corp. Counsel and Secretary, Intel Corp.; testimony of Richard Stern, Copyright Counsel for Intersil, a General Electric subsidiary; testimony of A.G.W. Biddle, President of the Computer & Communications Industry Association; statement of Robert Hinckley, General Counsel, NEC Electronics).

them without the patent holder's permission. Finally, because the patent examination system consumes a substantial amount of time, during which the innovator's lead time steadily erodes,[153] and given the semiconductor industry's incredible rate of innovation, the innovator's product may become obsolete during the time required for patent acquisition.

D. COPYRIGHT PROTECTION

The semiconductor industry seeks relief from photolithographic copying.[154] Because copyright prohibits copying, it is not surprising that copyright principles are almost ideally suited for protecting semiconductor chips. Copyright demands a relatively low threshold of creativity for protection, unlike the rigorous standard of innovation demanded by the patent laws.[155] Protection extends immediately[156] and does not prevent independent creation of equivalents.[157]

Despite its suitability, the Copyright Act does not protect semiconductor chips, or any other utilitarian articles.[158] Although deeply entrenched in copyright law, the barriers to copyright protection for utilitarian articles do not appear to be constitutionally mandated,[159] but, instead, these doctrinal barriers reflect concern over granting monopoly protection to useful articles that have not qualified for patent protection.[160] The copyright monopoly, however, provides considerably less power than the patent monopoly. To a large extent, concern over extending copyright to utilitarian articles is misplaced, though not entirely so, as discussed in Section VI of this Article. Hence, copyright law could be applied to semiconductor chips, just as it has been applied to computer programs.

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153. *1983 Senate Hearing, supra* note 5, at 50 (statement of Dorothy Schrader, Associate Register of Copyrights for Legal Affairs and General Counsel for the U.S. Copyright Office).

154. *See supra* text accompanying note 12.

155. Only originality is required for copyright protection; the much higher standards of novelty and nonobviousness are demanded for patent protection. *See* Knickerbocker Toy Co. v. Winterbrook Co., 554 F. Supp. 1309, 1317 (D. N.H. 1981) ("The test of originality is concededly one with a low threshold."). *Compare* Graham v. John Deere, 383 U.S. 1, 17 (1966) (using a three-step test for determining nonobviousness).

156. Copyright law automatically protects the author once the work is fixed in a tangible medium of expression. 17 U.S.C. § 102(a) (1976).

157. Sheldon v. Metro-Goldwyn Pictures Corp., 81 F.2d 49, 54 (2d Cir. 1936), *cert. denied*, 298 U.S. 699 (1936).

158. *See 1983 Senate Hearing, supra* note 5, at 27-28 (statement of Dorothy Schrader, Associate Register of Copyrights for Legal Affairs and General Counsel for the U.S. Copyright Office).

159. *See* Miller Statement *supra* note 145, at 2-3.

160. *See infra* Section V(C).

Congress, in an attempt to avoid disruption of settled copyright doctrine, chose to enact sui generis protection for semiconductors in the Chip Act. While acknowledging the appropriateness of copyright as a form of protection, Congress explicitly patterned the sui generis legislation on copyright principles.[161]

1. *An Introduction to Copyright Law*

Like the patent laws, the copyright laws derive their origin from Article I, section 8 of the United States Constitution which states: "The Congress shall have Power . . . To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries."[162] Copyrights, like patents, are granted in the "conviction that encouragement of individual effort by personal gain is the best way to advance public welfare . . . ."[163] The words "authors" and "writings" define the permissible constitutional reach of copyright law.

The word "writings" serves as the most significant constitutional limitation in the copyright clause.[164] The courts have liberally construed the term.[165] "[W]ritings . . . include any physical rendering of the fruits of creative intellectual or aesthetic labor" and are not "construed in their narrow literal sense but, rather, with the reach necessary to reflect the broad scope of constitutional principles."[166] In *Reiss v. National Quotation Bureau*, Judge Learned Hand stated that the Constitution does not

> embalm inflexibly the habits of 1789 . . . . [I]ts grants of power to Congress comprise, not only what was then known, but what the ingenuity of men should devise thereafter. Of course, the new subject-matter must have some relation to the grant; but we interpret it by the general practices of civilized people in similar fields, for it is not a strait-jacket, but a charter for a living people.[167]

The term has not been limited to script or printed material; it includes all forms of writing, printing, engraving, etching, and similar materials.[168]

Although the term "writings" is generally construed broadly, the

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161. *See* Amendment to Semiconductor Chip Protection Act, 130 CONG. REC. No. 129, Part II, S12,923-25 (daily ed. Oct. 3, 1984) [hereinafter Mathias-Leahy Amendment].

162. U.S. CONST. art. I, § 8, cl. 8.

163. Mazer v. Stein, 347 U.S. 201, 219 (1954).

164. 1 M. NIMMER, NIMMER ON COPYRIGHT § 1.08[A] (1984).

165. *Id. See generally* Note, *Study of the Term "Writings" in the Copyright Clause of the Constitution*, 31 N.Y.U. L. REV. 1263 (1956).

166. Goldstein v. California, 412 U.S. 546, 561 (1973).

167. 276 Fed. R. Serv. 717 (S.D.N.Y. 1921).

168. *Id.* at 719. *See Trade-Mark Cases*, 100 U.S. 82, 94 (1879). *See generally* 1 M. NIMMER, *supra* note 164, § 1.08[B].

term does have some restrictions. It only extends to works which "are *original*, and are founded in the creative powers of the mind."[169] If inventiveness is the measurement for patent entitlement, originality is the copyright equivalent.[170] The requirement of originality has been inferred from the terms "writings" and "authors" used in the Constitution.[171] "All that is needed to satisfy . . . [the Constitution] is that the 'author' contributed something more than a 'merely trivial' variation, something recognizably 'his own' . . . . No matter how poor artistically the 'author's' addition, it is enough if it be his own."[172] Originality therefore requires only a minimum showing of creativity.[173] In addition to being original, a writing must also be embodied in physical form.[174]

Congress incorporated into the Copyright Act of 1976[175] the standards of originality which have been established by the courts.[176] Congress emphasized the distinction between the patent and copyright laws and noted that the definition of originality established in the Copyright Act of 1976 "does not include requirements of novelty, ingenuity, or aesthetic merit, and there is no intention to enlarge the standard of copyright protection to require them."[177] Section 102 states, in part, that "copyright protection subsists . . . in original works of authorship . . . ."[178]

Section 102 requires physical embodiment of original expressions. Accordingly, original works of authorship must be "fixed in [a] tangible

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169. *Trade-Mark Cases*, 100 U.S. at 94 (trademark held not a writing worthy of copyright protection). *See also* Brown Instrument Co. v. Warner, 161 F.2d 910 (D.C. Cir. 1947) (blank charts used to record facts held not to constitute writings).

170. *See* D. CHISUM, INTELLECTUAL PROPERTY: COPYRIGHT, PATENT, AND TRADEMARK § 2.01 (1980).

171. Du Puy v. Post Telegram Co., 210 F. 883 (3d Cir. 1914). *See generally* Note, *"Expression" and "Originality" in Copyright Law*, 11 WASHBURN L.J. 400 (1972).

172. Alfred Bell & Co. v. Catalda Fine Arts, Inc., 191 F.2d 99, 102-03 (2d Cir. 1951).

173. *See* Knickerbocker Toy Co. v. Winterbrook Co., 554 F. Supp. 1309, 1317 (D. N.H. 1982). *See also* Note, *supra* note 171, at 400 (Courts have applied three tests to determine whether a work possesses originality: (1) was the work created by the author's own labor; (2) was the author's work a distinguishable variation from works already in the public domain; (3) does the work owe its origin to the authors.).

174. Although no decisions have directly so held, the word "writing" seems to require a physical embodiment. 1 M. NIMMER, *supra* note 164, § 1.08[C][2]. *See generally* Goldstein v. California, 412 U.S. 546, 561 (1973) ("[W]ritings . . . include any physical rendering of the fruits of creative intellectual or aesthetic labor."); Trade-Mark Cases, 100 U.S. 82, 94 (1879) ("[W]ritings . . . are the fruits of intellectual labor, embodied in the form of books, prints, engravings, and the like." (emphasis omitted)).

175. Pub. L. No. 94-553, 90 Stat. 2541 (1976) (codified at 17 U.S.C. §§ 101-810).

176. H.R. REP. NO. 1476, *supra* note 63, at 51, 1976 U.S. CODE CONG. & ADMIN. NEWS at 5664.

177. *Id.*, 1976 U.S. CODE CONG. & ADMIN. NEWS at 5664.

178. 17 U.S.C. § 102(a)(1976).

medium of expression" to obtain copyright protection.[179] A work is considered fixed "when its embodiment . . . is sufficiently permanent or stable to permit it to be perceived . . . for a period of more than transitory duration."[180]

Copyright requires minimal creativity in order to qualify for protection, and affords protection of a correspondingly narrow scope. A copyright protects only the author's expression, not the idea behind it.[181] Further, copyright only prohibits misappropriation of the author's expression and does not preclude independent creation of an identical work.[182] As Judge Learned Hand noted: "Borrowed the work must indeed not be, for a plagiarist is not himself pro tanto an 'author'; but if by some magic a man who had never known it were to compose a new Keat's Ode on a Grecian Urn, he would be an 'author' . . . ."[183]

2. *The Copyright Process*

Copyright law affords self-executing protection. As section 102(a) states: "Copyright protection subsists . . . in original works of authorship fixed in any tangible medium of expression . . . ."[184] Indeed, copyright protection will exist despite the author's failure to register and deposit a copy of the work with the Copyright Office.[185] Without registration, however, the copyright holder cannot exercise certain critical rights. For example, an author cannot sue for copyright infringement until the copyright is registered.[186] Moreover, without registration a copyright holder cannot recover either attorneys' fees or statutory damages.[187]

The registration process is a simple one. The copyright owner submits at least one copy of the work together with a copyright application, and an application fee.[188] The application requires only general infor-

179. *Id.*

180. *Id.* § 101 (1976).

181. *See* Baker v. Selden, 101 U.S. 99 (1879). *See also* Continental Casualty Co. v. Beardsley, 253 F.2d 702, 706 (2d Cir. 1958), *cert. denied*, 358 U.S. 816 (1959) ("[T]he proper standard of infringement is one which will protect as far as possible the copyrighted language and yet allow the free use of the thought beneath the language."). The idea-expression distinction is critical in copyright law and is discussed in Section V(D) of this Article.

182. Knickerbocker Toy Co. v. Winterbrook Co., 554 F. Supp. 1309, 1317 (D. N.H. 1982) ("[C]opyright protection may under certain circumstances [e.g., independent creation], extend to two works similar or even identical in expression.").

183. Sheldon v. Metro-Goldwyn Pictures Corp., 81 F.2d 49, 54 (2d Cir. 1936), *cert. denied*, 298 U.S. 699 (1936).

184. 17 U.S.C. § 102(a) (1976).

185. *Id.* § 408(a).

186. *Id.* § 411.

187. *Id.* § 412.

188. *Id.* §§ 408-409, 708.

mation about the author and the work created.[189] After an examination of the work submitted, to ensure that it constitutes copyrightable subject matter, an inspection of the application form, and a review of any other required documents, the Register of Copyrights will register the copyright claim and issue a certificate of registration to the author.[190]

The effect of copyright protection is that it prohibits copying, but it does not prohibit independent creation of equivalents. Thus, the risk of knowledge monopolization through the use of copyright laws is substantially less than the risk under the patent laws and, as a result, the standards for copyright protection are not as restrictive as those for patent protection.

A valid copyright grants its owner the exclusive right to: (1) reproduce the copyrighted work; (2) prepare derivative works based on the copyrighted work; (3) distribute copies or phonorecords of the copyrighted work; (4) perform the copyrighted work publicly; and (5) display the copyrighted work.[191] Copyright protection "endures for a term consisting of the life of the author and fifty years after the author's death."[192]

3. *Copyright Protection for Semiconductor Chips*

As a broad constitutional matter, nothing prevents protection of semiconductor chips under copyright law. Because semiconductor chips, and the associated designs and masks, represent the "physical rendering of the fruits of creative intellectual . . . labor," they are protectable under the Constitution's copyright power.[193] Although the Copyright Act of 1976 specifies only "original works of authorship,"[194] a category somewhat narrower in scope than that embraced by the constitutional term "writings,"[195] chips nevertheless appear to qualify for copyright protection.

Semiconductor chips owe their origin to industry designers who expend considerable intellectual effort in their creation. Moreover, as evidenced by the relatively short lifespans of semiconductor products, innovative concepts are constantly incorporated in new chips.[196] New semiconductor chips seemingly reflect more than "merely trivial" varia-

189. *Id.* § 409.
190. *Id.* § 410.
191. *Id.* § 106.
192. *Id.* § 302(a).
193. Goldstein v. California, 412 U.S. 546, 561 (1973).
194. 17 U.S.C. § 102(a) (1976).
195. Although Congress elected not to provide copyright protection for all "writings" in the Copyright Act of 1976, the term, "works of authorship," is, nevertheless, read broadly. 1 M. NIMMER, *supra* note 164 § 2.03[A].
196. *See supra* text accompanying note 28.

tions from their predecessors.[197] At the very least, the chips display the minimal level of creativity that "originality" requires.[198] The designs, masks, and chips themselves clearly comprise a designer's conceptualization embodied or "fixed" in a "tangible medium of expression."[199] Thus, semiconductor chips, masks, and designs seem to be copyrightable.

Copyright protection is clearly unavailable, however, for semiconductor chip manufacturing processes. In *Baker v. Selden*,[200] the Supreme Court considered whether copyright protection was available for an accounting system. The author of a book which described the author's bookkeeping system sought protection for various forms included in the book which were meant to be used with the system. The author argued that the forms were an essential component of his bookkeeping system and, because the forms were copyrighted, the system could not be used without his permission.

The Court held that although copyright law protected the author's book, the law did not prohibit others from applying the bookkeeping system that the book described. The Court took the position that

> [t]o give to the author of the book an exclusive property in the art described therein, when no examination of its novelty has ever been officially made, would be a surprise and a fraud upon the public. That is the province of letters-patent, not of copyright. The claim to an invention or discovery of an art or manufacture must be subjected to the examination of the Patent Office[;] . . . it can only be secured by a patent from the government.[201]

The Court held that protection for manufacturing processes must come from trade secret or patent law, if at all. Because the semiconductor industry's paramount interest is protection of the semiconductor chip, control over the mask works or manufacturing processes is significant only so far as it facilitates that goal.[202]

V. COPYRIGHT PROTECTION FOR UTILITARIAN ARTICLES

A. DOCTRINAL BARRIERS TO PROTECTION OF UTILITARIAN ARTICLES

Although copyright appears to be best-suited for semiconductor chip protection and that protection seems to be constitutionally permissible, three major doctrinal barriers prohibit copyright protection for

197. Alfred Bell & Co. v. Catalda Fine Arts, Inc., 191 F.2d 99, 102-03 (2d Cir. 1951).

198. *See supra* note 173.

199. 17 U.S.C. § 102(a)(1976).

200. 101 U.S. 99 (1879).

201. *Id.* at 102.

202. *See 1983 Senate Hearing*, *supra* note 5, at 63 (testimony of F. Thomas Dunlap, Jr., Corp. Counsel and Secretary, Intel Corp.).

semiconductor chips: (1) copyright does not protect useful articles per se; (2) copyright protects the design of a useful article only to the extent that it can be identified separately from, and is capable of existing independently of, the utilitarian aspects of the article; and (3) copyright protects only expression, not ideas, plans, or processes.[203]

Courts have consistently refused to extend copyright to useful articles per se. For example, in *Clair v. Philadelphia Storage Co.*,[204] the court was presented with an attempt to protect a radio cabinet design through copyright. The court rejected the effort to extend copyright to the design, holding that "[c]opyright infringement . . . can only be based upon appropriation of copyrightable subject matter. It is conceded that the idea, as distinguished from the expression of it, has utility and that the arrangement has a functional value. These things are not copyrightable attributes of a design."[205]

The court in *Taylor Instrument Co. v. Fawley-Brost Co.*[206] used a similar analysis in denying copyright protection to a thermometer chart intended for use in conjunction with the plaintiff's thermometer.

> The chart is as indispensable to the operation of a recording thermometer as are any of the other elements. They are interdependent . . . . [T]he chart neither teaches nor explains the use of the art. It is an essential element of the machine; it is the art itself. It is our judgment that plaintiff's charts are not the proper subject of copyright . . . .[207]

In one way, these cases show the courts' recognition of the distinction between idea and expression. Only expression is protectable under copyright. This distinction is discussed in Section V(D) of this Article. Broadly construed, these cases demonstrate judicial concern over protection of useful articles through copyright.

The Copyright Act of 1976 defines a "useful article" as "an article having an *intrinsic* utilitarian function that is not merely to portray the appearance of the article or to convey information."[208] This definition was largely derived from a regulation issued earlier by the Copyright Office with one significant change: the regulation defined a useful article as one having "*sole* utilitarian function."[209] The definition in the Copyright Act of 1976, however, takes a stricter approach in extending

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203. *See id.* at 27-28 (statement of Dorothy Schader, Associate Register of Copyrights for Legal Affairs and General Counsel for the U.S. Copyright Office).

204. 43 F. Supp. 286 (E.D. Pa. 1941).

205. *Id.* at 287.

206. 139 F.2d 98 (7th Cir. 1943), *cert. denied*, 321 U.S. 785 (1943).

207. *Id.* at 100. *See also* Brown Instrument Co. v. Warner, 161 F.2d 910, 911 (D.C. Cir. 1947), *cert. denied*, 332 U.S. 801 (1947) ("Articles intended for practical use . . . are not copyrightable.").

208. 17 U.S.C. § 101 (1976) (emphasis added).

209. 37 C.F.R. § 202.10(c) (1976) (emphasis added).

copyright protection.[210] Under this stricter standard, chips and masks clearly constitute useful articles because an intrinsic function, if not the sole intrinsic function, of the semiconductor chip is the control of electrical impulses. Similarly, masks are primarily, if not solely, employed in the manufacture of semiconductor chips. The design of a semiconductor chip, however, could be protected because one might argue that it "merely . . . convey[s] information."[211]

Nonetheless, the Copyright Act of 1976 extends only limited protection for the designs of utilitarian articles. Under its provisions, copyright protects the design of a useful article only to the extent that artistic features "can be identified separately from, and are capable of existing independently of, the utilitarian aspects of the article."[212]

The doctrine of "conceptual separability" in the Copyright Act of 1976 can be traced to the decision in *Mazer v. Stein*.[213] In that case, the respondent manufactured and marketed lamps. Statuettes shaped like Balinese dancers served as lamp bases. After removing the other lamp components, the respondent submitted the statuette bases for copyright registration. Petitioner then began wholesale copying of the bases. In the ensuing copyright infringement action, the petitioner claimed that as an element of a utilitarian object, only patent law could protect the lamp design. The Supreme Court rejected this contention, stating, "We find nothing in the copyright statute to support the argument that the intended use or use in industry of an article eligible for copyright bars or invalidates its registration."[214]

The Court noted that the legislative history of the Copyright Act of 1909 indicated that the statuettes constituted protectable subject matter under copyright.[215] Existing regulations issued by the Copyright Office protected artistic articles in "form but not their mechanical or utilitarian aspects."[216] Moreover, the Court, recalling its decision in *Baker v.*

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210. *See* Esquire Inc. v. Ringer, 591 F.2d 796, 804 (D.C. Cir. 1978), *cert. denied*, 440 U.S. 908 (1979). As the *Esquire* court noted:

> In deleting the modifier "sole" from the language taken from § 202.10(c), the draftsmen of the 1976 Act must have concluded that the definition of "useful article" would be more precise without this term. Moreover, Congress may have concluded that literal application of the phrase "sole intrinsic function" would create an unworkable standard. For as one commentator has observed, "[t]here are no two-dimensional works and few three-dimensional objects whose design is absolutely dictated by utilitarian considerations" (citation omitted).

Id. at 804.

211. *Id.*

212. *See* 17 U.S.C. § 101 (1976) (definition of "pictorial, graphic, and sculptural works").

213. 347 U.S. 201.

214. *Id.* at 218.

215. *Id.* at 211.

216. *Id.* at 212-13 (quoting 37 C.F.R. § 202.8 (1949)).

Selden,[217] distinguished the protections provided by a patent from those afforded by a copyright: "Unlike a patent, a copyright gives no exclusive right to the art disclosed; protection is given only to the expression of the idea—not the idea itself."[218] Hence, the Court held respondents could prevent others from copying the artistic form of their statuettes, but could not preclude others from using human figures as lamp bases.[219]

In response to the Court's decision in *Mazer*, Congress added language to the definition of "pictorial, graphic, and sculptural works" to emphasize that such works were to include "works of artistic craftsmanship insofar as their form but not their mechanical or utilitarian aspects are concerned. . . ."[220] Nevertheless, the House Committee on the Judiciary emphasized that the new definition was not intended to extend copyright protection to useful articles as such.

Because courts have "assiduously avoided adopting the critic's role in evaluating the aesthetic merits of works of authorship,"[221] it is not surprising that the doctrine of conceptual separability is not easily applied.[222] In *Norris Industries, Inc. v. Int'l Tel. & Tel. Corp.*[223] the design of wirespoked wheel covers was held to be outside copyright protection. The court noted that the "wheelcovers do not contain a superfluous sculptured design, serving no function, that can be identified apart from the wheelcovers themselves."[224] In contrast, in *Kieselstein-Cord v. Accessories by Pearl, Inc.*[225] the artistic elements in a belt buckle design were held to be conceptually separable from their utilitarian function.

Although the doctrine of conceptual separability may present application difficulties, few such concerns arise in the context of semiconductor products. Functional considerations determine semiconductor form. The resulting product may display artistic elements, but those elements

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217. 101 U.S. 99 (1879).

218. *Mazer*, 347 U.S. at 217.

219. *Id.* at 218.

220. H.R. REP. NO. 1476, *supra* note 63, at 54, 1976 U.S. CODE CONG. & ADMIN. NEWS at 5667.

221. *See* CONTU FINAL REPORT, *supra* note 48, at 25. *See also Mazer*, 347 U.S. at 214 ("Individual perception of the beautiful is too varied a power to permit a narrow or rigid concept of art.").

222. *See generally* Denicola, *Applied Art and Industrial Design: A Suggested Approach to Copyright in Useful Articles*, 67 MINN. L. REV. 707 (1983); Hauhart, *The Eternal Wavering Line—The Continuing Saga of Mazer v. Stein*, 6 HAMLINE L. REV. 95 (1983); Note, *Works of Applied Art: An Expansion of Copyright Protection*, 56 S. CAL. L. REV. 241 (1982).

223. 696 F.2d 918 (11th Cir. 1983), *reh'g denied*, 703 F.2d 582, *cert. denied*, 464 U.S. 818 (1983).

224. *Id.* at 924.

225. 632 F.2d 989 (2d Cir. 1980).

arise unintentionally or fortuitously. The House Committee which drafted the addition to the definition of "pictorial, graphic, and sculptural works" stated:

> [T]he Committee is seeking to draw as clear of a line as possible between copyrightable works of applied art and uncopyrighted works of industrial design. A two-dimensional painting, drawing or graphic work is still capable of being identified as such when it is printed on or applied to utilitarian articles such as textile fabrics, wallpaper, containers, and the like. The same is true when a statue or carving is used to embellish an industrial product or, as in the *Mazer* case, is incorporated into a product without losing its ability to exist independently as a work of art. On the other hand, although the shape of an industrial product may be aesthetically satisfying and valuable, the Committee's intention is not to offer it copyright protection under the bill.[226]

Moreover, in the unlikely event that semiconductor design is found to display elements conceptually separable from the utilitarian function of the semiconductor chip itself, protection of the design cannot ensure protection of the chip.

Copyright in a drawing or other representation of a useful article does not protect against unauthorized duplication of the useful article, as the opinion in *Imperial Homes Corp. v. Lamont*[227] illustrates. Imperial Homes Corp. designed, constructed, and then sold residential dwellings. Using architectural plans it developed and copyrighted, Imperial Homes constructed model homes for public display. During a visit to one of these model homes, the Lamonts made detailed structural observations and measurements from which they allegedly developed their own architectural plans. From those plans, they constructed their own home, a duplicate of the Imperial Homes model dwelling. Imperial Homes subsequently brought suit for infringement of their copyrighted architectural designs. On appeal, the court held that copyright in the architectural plans did not prevent the Lamonts from "reproducing a substantially identical residential dwelling."[228] Rather, copyright only prevented the Lamonts from copying the architectural plans belonging to Imperial Homes. The court noted that the "exclusive right to *copy* what is copyrighted belongs to the architect, . . . the plans give him no unique claim on any feature of the structure they detail."[229] The case was remanded for a determination as to whether the Lamonts had copied the plans belonging to Imperial Homes.

Based on the foregoing, even if semiconductor designs could meet

226. H.R. REP. NO. 1476, *supra* note 63, at 55, 1976 U.S. CODE CONG. & ADMIN. NEWS at 5668.

227. 458 F.2d 895 (5th Cir. 1972).

228. *Id.* at 899.

229. *Id.*

the requirements of the conceptual separability doctrine to obtain copyright protection, the semiconductor chip itself would remain unprotected. Reconsider *Imperial Homes* as an illustration. Suppose that the Lamonts purchased an Imperial Homes dwelling rather than carefully measuring a model home. Further, imagine that they disassembled *their* home and, based on information they acquired during disassembly, began to construct duplicate homes elsewhere. At no point would the Lamonts have infringed the Imperial Homes copyright by *copying* architectural layouts.

As in the illustration above, pirates do not copy semiconductor layouts. Rather, after purchasing a target semiconductor chip, pirates disassemble the chip and photograph each chip layer exposed. Under *Imperial Homes,* there would be no copyright infringement. Although industry proponents might claim that the design is embodied in the chip itself, the chip does not merely convey information. Protection of a semiconductor chip design is not equivalent to semiconductor chip protection; the chips themselves need protection.

B. Copyright Protection for Utilitarian Articles Offers a Valuable Alternative to Patent Law as an Incentive for Innovation

As discussed in the preceding section of this Article, the three doctrinal barriers to copyright protection for utilitarian articles are: (1) copyright does not protect useful articles per se; (2) copyright protects the design of a useful article only to the extent that it can be identified separately from, and is capable of existing independently of, the utilitarian aspects of the article; and (3) copyright protects only expression, not ideas, plans, or processes. These three barriers reflect that, under the intellectual property laws, "everyone has the right to use an article for its functional purpose, subject only to limited patent protection."[230] Further, it is maintained that providing monopoly protection beyond that available under the patent laws would unnecessarily limit access to ideas and constrain commercial competition.[231]

Accordingly, "[t]rademark law recognizes an overriding public policy of preventing monopolization of the use of articles which are mainly

230. Fotomat Corp. v. Photo Drive-Thru, Inc., 425 F. Supp. 693, 705 (D.N.J. 1977).

231. [I]n rewarding useful invention, "the rights and welfare of the community must be fairly dealt with and effectually guarded." . . . To that end the prerequisites to obtaining a patent are strictly observed, and when the patent has issued the limitations on its exercise are equally strictly enforced. To begin with, a genuine "invention" or "discovery" must be demonstrated "lest in the constant demand for new appliances the heavy hand of tribute be laid on each slight technological advance in an art."

Sears, Roebuck & Co. v. Stiffel Co., 376 U.S. 225, 229 (1964) (citations omitted).

functional or utilitarian. . . ."[232] Similarly, "[t]o give an author . . . an exclusive right to manufacture the art described in the certificate of copyright registration, when no official examination of its novelty has ever been made, would unjustly create a monopoly and, moreover would usurp the functions of letters-patent."[233] Unlike trademark, however, copyright can never truly usurp patent law.

If trademark protection of a functional feature was permitted, it would prevent all competitors from using that protected feature.[234] State unfair competition laws prohibiting the copying of functional features that cause "confusion as to the source" might also prevent competition.[235] In contrast, copyright prohibits copying; it cannot prevent independent creation of items equivalent to the copyright article.[236] Moreover, "[u]nlike a patent, a copyright gives no exclusive right to the art disclosed; protection is given only to the expression of the idea—not the idea itself."[237] A copyright cannot possess the preclusive anticompetitive power which a patent can possess. If it is true that the policy of encouraging invention through the use of patents is not disturbed by the existence of another form of incentive to invention, then copyright law affords an attractive alternative to patent law—one at least as attractive as trade secret law.

By protecting the results of research and development, copyright protection would both encourage and subsidize such efforts. Like trade secret law, copyright law could increase "economic efficiency within large companies through the dispersion of . . . creative developments,"[238] "encourage invention in areas where patent law does not reach,"[239] and "prompt the independent innovator to proceed with the discovery and exploitation of his invention."[240] Similarly, copyright protection is compatible with "the policy that matter once in the public domain must remain in the public domain. . . ."[241] Although prospective authors are free to employ what exists in the public domain in their works, they cannot merely appropriate that which exists therein. Prospective authors must contribute their own creative efforts—copyright

232. *Fotomat*, 425 F. Supp. at 705.

233. Jack Adelman, Inc. v. Sonner & Gordon, Inc., 112 F. Supp. 187, 190 (S.D.N.Y. 1934).

234. 15 U.S.C. § 1114 (1963).

235. *Sears Roebuck*, 376 U.S. at 227. Of course, the *Sears Roebuck* decision and its companion case Compco Corp. v. Day-Brite Lighting, Inc., 376 U.S. 234 (1964), largely abolished such state unfair competition laws.

236. *See supra* text accompanying note 182.

237. Mazer v. Stein, 347 U.S. 201, 217 (1954).

238. Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 482 (1974).

239. *Id.* at 485.

240. *Id.*

241. *Id.* at 484.

extends only to those works displaying originality.[242] Furthermore, like trade secret law, copyright law cannot prevent independent creation of equivalents.[243] Finally, copyright does not intrude upon the "patent policy of disclosure."[244] Unlike trade secret law, in which protection depends upon secrecy,[245] copyright law demands disclosure.[246] To the extent that the availability of copyright protection deters industry use of trade secret law, disclosure is actually enhanced.

Indeed, such considerations led the CONTU majority to recommend amendments to the Copyright Act of 1976 which would extend copyright protection to computer programs, despite their utilitarian function.[247] Notably, for reasons which parallel those given in this Article for finding existing intellectual property laws ineffective in protecting semiconductor chips, the CONTU majority rejected unfair competition, trade secret, and patent laws as unsuitable for protecting computer programs.[248] In sum, copyright could extend its protection to semiconductor chips, despite their utilitarian functions, just as it has already extended its protection to computer programs.

C. An Examination of Copyright Protection of Computer Operating Systems

The legislative history of the Copyright Act of 1976 suggests that Congress considered computer programs copyrightable as literary works.[249] In 1974, Congress created CONTU to study the scope of protection to be afforded computer programs.[250] In 1980, Congress revised the copyright laws in accordance with CONTU's recommendations.[251] A "computer program" was defined as "a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result."[252] The new law also provided that "it is not an

242. *See supra* notes 169-74 and accompanying text.

243. *See Kewanee Oil*, 416 U.S. at 476; Sheldon v. Metro-Goldwyn Pictures Corp., 81 F.2d 49, 54 (2d Cir. 1936), *cert. denied*, 298 U.S. 699 (1936).

244. *Kewanee Oil*, 416 U.S. at 485.

245. *See supra* notes 70-73 and accompanying text.

246. *See supra* notes 185-87 and accompanying text.

247. CONTU Final Report, *supra* note 48, at 1.

248. *Id.* at 16-18.

249. The term "literary works" does not connote any criterion of literary merit or qualitative value: it includes catalogs, directories, and similar factual, reference, or instructional works and compilations of data. It also includes computer data bases and computer programs to the extent that they incorporate authorship in the programmer's expression of original ideas, as distinguished from the ideas themselves.

H.R. Rep. No. 1476, *supra* note 63, at 54, 1976 U.S. Code Cong. & Admin. News at 5667.

250. Pub. L. No. 93-573, § 201, 88 Stat. 1873 (1974).

251. Pub. L. No. 96-517, § 10, 94 Stat. 3015, 3028 (1980).

252. 17 U.S.C. § 101 (1980).

infringement for the owner of a copy of a computer program to make or authorize the making of another copy or adaptation of that computer program. . ." when necessary for the utilization of the computer program or for archival purposes only.[253]

One issue which was not clearly addressed in the CONTU *Final Report* was that copyright doctrine traditionally limited protection afforded to utilitarian articles. Although the distinction between utilitarian and nonutilitarian works has never been clear,[254] the 1980 amendments to the Copyright Act acknowledge the functional purpose of computer programs and, nevertheless, extend copyright protection to computer programs. Extending copyright protection to computer programs, which serve predominantly utilitarian purposes, diminishes the force of other copyright doctrine which bars protection for useful articles.

In the CONTU *Final Report,* the majority noted the "broad and dynamic meaning" given to the word "writing" in the Constitution, citing with approval the words of Judge Learned Hand: "[O]ur Constitution [does not] embalm inflexibly the habits of 1789 . . . its grants of power to Congress comprise, not only what was then known, but what the ingenuity of man should devise thereafter."[255] Consequently, the majority declared that computer programs "are writings in the constitutional sense and eligible for copyright if Congress so provides."[256] After observing that Congress clearly intended to offer copyright protection to programs and rejecting alternative methods of protection,[257] the majority examined the scope of copyright protection to be afforded.

Commissioner Hershey's dissent commented that works of authorship were intended for communication with human beings and, in written form, computer programs resemble copyrightable printed instruction lists intended to direct individuals in their work.[258] Unlike printed instruction lists, however, "computer programs, in their mature phase, are addressed to machines."[259] Commissioner Hershey stated:

> In the case of computer programs, *the instructions themselves eventually become an essential part of the machinery that produces the results.* They may become (in chip or hardware form) a permanent part

253. 17 U.S.C. § 117 (1980).

254. *Compare* Kieselstein-Cord v. Accessories by Pearl Inc., 632 F.2d 989 (2d Cir. 1980) (copyright protection granted for belt buckle design) *with* Norris Industries v. Int'l Tel. & Tel. Corp., 696 F.2d 918 (11th Cir.), *cert. denied,* 464 U.S. 818 (1983) (copyright protection denied for wire-spoked wheel cover design).

255. CONTU FINAL REPORT, *supra* note 48, at 14 (quoting Reiss v. National Quotation Bureau, Inc., 276 Fed. R. Serv. 717, 719 (S.D.N.Y. 1921)).

256. *Id.* at 15.

257. *See supra* text accompanying note 248.

258. CONTU FINAL REPORT, *supra* note 48, at 28.

259. *Id.*

> of the actual machinery; or they may become interchangeable parts, or tools, insertable into and removable from the machine. In whatever material form, the machine-control phase of the program, when activated, enters into the computer's mechanical process. This is a device capable of commanding a series of impulses which open and close the electronic gates of the computer in such order as to produce the desired result.[260]

Commissioner Hershey believed that any copyright protection extended to computer programs should acknowledge their utilitarian nature. Consequently, his recommendation to Congress was that the Copyright Act of 1976 "should be amended to make it explicit that copyright protection does not extend to a computer program in the form in which it is capable of being used to control computer operations."[261]

Commissioner Nimmer concurred in the majority's opinion, but expressed concern over "open-ended copyright protection for all computer software. . ." and observed that the majority never "articulate[d] any rationale which would not equally justify copyright protection for the tangible expression of any and all original ideas. . . ."[262] Thus, he suggested that copyright protection be limited to those "computer programs which produce works which themselves qualify for copyright protection."[263]

The CONTU majority, however, rejected the concerns of Commissioners Hershey and Nimmer, and contended that the Copyright Act of 1976 was designed to protect all works of authorship from the moment of their fixation in a tangible medium of expression.[264] The majority declared that "copyright practice past and present . . . recognizes copyright protection for a work of authorship regardless of the uses to which it may be put," and further stated that copyright has never "been de-

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260. *Id.* (emphasis in original). *See also* Patterson, *Microprogramming*, SCI. AM., Mar. 1983, at 50 (The most advanced semiconductor chips, microprocessors and microcomputers, often contain fixed computer programs.).

261. CONTU FINAL REPORT, *supra* note 48, at 37.

262. *Id.* at 26.

263. *Id.* at 27. Commissioner Nimmer noted that under his proposed standard:

> A program designed for use with a data base, for example, would clearly be copyrightable since the resulting selection and arrangement of items from such data base would itself be copyrightable as a compilation. Thus, a program designed for use in conjunction with a legal information retrieval system would be copyrightable, since the resulting enumeration of cases on a given topic could claim copyright . . . . On the other hand, programs which control the heating and air conditioning in a building, or which determine the flow of fuel in an engine, or which control traffic signals would not be eligible for copyright because their operations do not result in copyrightable works. The fact that such a program might also provide for a print out of written instructions (which would be copyrightable) would only render protectible that particular aspect of such a program.

Id.

264. *Id.* at 21.

nied to works simply because of their utilitarian aspects."[265] Consequently, the CONTU majority concluded that flow charts, source codes, and object codes are works of authorship in which copyright subsists, provided that they are the product of sufficient intellectual labor to surpass the "insufficient intellectual labor hurdle."[266] The majority stressed that, in keeping with established copyright doctrine, copyright protection in computer programs extends only to expressions, not to ideas.[267]

Despite claims to the contrary, the CONTU majority's recommendations represent a departure from established copyright doctrine. This departure is most evident when the availability of copyright protection for computer programs imbedded in semiconductor chips is considered. First, however, the computer programming process must be understood.

The computer programmer initially examines the system for which a program must be designed and creates a conceptual design for the program which is translated into a formal notation system, such as a structured flow chart, pseudo-code, or other formal language. The programmer translates this notation into a programming language.

A computer program may be written in three different levels of computer language. High level languages, such as BASIC or FORTRAN, use English words and symbols. Lower level assembly language consists of alphanumeric labels; for example, the label "ADC" means "add with carry." High level language and assembly language programs are described as written in source code. Programs in machine language, the lowest level language, are written in binary language with only two symbols, 0 and 1. These symbols actually indicate open (0) or closed (1) electrical switches.[268] In this form, programs are described as written in object code.[269]

The computer is the target of the instructions in a computer program. The control center of the computer is the central processing unit (CPU), an integrated circuit which executes instructions given to it.[270]

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265. *Id.*

266. *Id.*

267. *Id.* at 18-23. The idea-expression dichotomy is discussed in section V(D) of this Article.

268. *See generally* Apple Computer, Inc. v. Franklin Computer Corp., 714 F.2d 1240, 1243 (3d Cir. 1983), *cert. dismissed*, 464 U.S. 1033 (1984).

269. For a general discussion of availability of copyright protection for computer programs written in object code, see Note, *Copyright Protection of Computer Program Object Code*, 96 HARV. L. REV. 1723 (1983); Note, *Copyright: Computer Firmware: Is It Copyrightable?*, 36 OKLA. L. REV. 119 (1983).

270. The CPU serves as a manager of sorts for the computer. It performs the computer's arithmetic and logic functions, receives input data from input devices such as video terminals or card readers, obtains and inserts information in memory circuits, and passes out data to output devices such as printers or video terminals. To perform its many tasks,

The CPU only interprets instructions written in binary language; accordingly, computer programs must be transcribed in object code. Because working with object code is inconvenient,[271] programs are first written in source code, which is more easily manipulated by programmers, and then translated by a compiler program into object code for computer use.[272]

Programs used by the computer may be categorized as either operating system or application programs.[273] Operating system programs coordinate the various components of a computer system such as the CPU, memory, input, and output devices, and thereby manage the internal functions of the computer. Application programs perform specific computer tasks such as checkbook balancing or word processing, and function within the environment established by the operating system program.[274] Indeed, application programs tailored for use with one operating system program may not interact effectively with another operating system program. Operating system programs are the focus of the analysis that follows.

After the operating system is transcribed in object code, the program may be stored on magnetic tape, magnetic disk, or Read Only Memory (ROM) semiconductor chips.[275]

> At one time, operating systems and application programs were wired portions of the computer system. With the advance of [semiconductor] technology, it is now less costly and more efficient to place them in ROM form. Operating systems and applications programs in ROM form, however, still serve the same purpose as when they were hard wired.[276]

Despite the fact that an operating system program in a ROM chip is a functional part of the total computer system,[277] the court in *Apple v. Franklin* held that programs imbedded in semiconductor chips are protectable.[278] Operating system programs thus present the most obvious

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however, the CPU must be given instructions through the computer program. *See* Note, *Copyright Protection for Computer Programs in Read Only Memory Chips*, 11 HOFSTRA L. REV. 329, 335-37 (1982).

271. Machine language is binary language, which means that a single instruction might look like this: "0101100000110000." It is obvious that using machine language is inconvenient for the programmer because the instructions are difficult and each instruction performs only a small task. For example, it takes seven machine language instructions to execute C=A+B. *Id.* at 340.

272. *Apple v. Franklin*, 714 F.2d at 1243.

273. *Id.*

274. Note, *supra* note 270, at 347.

275. *Id.*

276. *Id.*

277. *Id.*

278. *Apple v. Franklin*, 714 F.2d at 1249 ("[A] computer program in object code embedded in a ROM chip is an appropriate subject of copyright.").

example of how copyright's doctrinal barriers have been blurred. Similar to the thermometer chart in *Taylor Instrument Cos. v. Fawley-Brost Co.*,[279] the operating system program is an essential element indispensable to the operation of the machine.[280] The operating system program's function is to control the computer's internal process, not merely to convey information. Accordingly, the operating system program appears to qualify as a "useful article."

Obviously, a computer program may exist independently of the machine. A computer program performs a utilitarian function only when employed in conjunction with a computer. Copyright law protects a program stored in a computer's memory, but copyright law does not protect the functioning of the machine.[281] The actual functioning of the computer does not constitute a "copy" protectable under copyright law.[282] Furthermore, copyright law does not extend to any "process, system, [or] method of operation . . . ."[283] Along these lines, the CONTU majority stated:

> When a program is copied into the memory of a computer, it still exists in a form from which a human-readable version may be produced. That is, the copy in the computer's memory may be duplicated, just as a version listed on paper or coded on magnetic tape may be. Only when the program is inserted—instruction by instruction—into the processing element of the computer and electrical impulses are sent through the circuitry of the processor to initiate work is the ability to copy lost. This is true at least under the present state of technology. If it should prove possible to tap off these impulses then, perhaps, the process would be all that was appropriated, and no infringement of the copyright would occur.
>
> The movement of electrons through the wires and components of a computer is precisely that process over which copyright has no control. Thus, copyright leads to the result that anyone is free to make a computer carry out any unpatented process, but not to misappropriate another's writing to do so.[284]

As Commissioners Hershey and Nimmer noted, the CONTU majority's distinctions deny reality. A program inert in ROM may indeed represent a "copy" of the programmer's original expression whenever detached from other components of computer hardware or attached to a machinery simply to examine the contents loaded within the ROM. Yet, once the "copy" is linked to computer components for more than "archival" purposes, it exists to perform work—the program imbedded

279. 139 F.2d 98 (7th Cir. 1943), *cert. denied*, 321 U.S. 785 (1943).
280. *Id.* at 100.
281. *See* CONTU FINAL REPORT, *supra* note 48, at 22.
282. 17 U.S.C. §§ 101, 102(a) (1976).
283. *Id.* § 102(b).
284. CONTU FINAL REPORT, *supra* note 48, at 22.

in ROM is a machine element. Thus, machine and expression are intimately intertwined.

In computer operations, program and machine interact so closely that their individual functions are virtually inseparable.[285] The Court of Customs and Patent Appeals (CCPA) has held that a programmed computer may be patented, even if the machine alone may not:

> [A] general-purpose digital computer may be regarded as but a storeroom of parts and/or electrical components. But once a program has been introduced, the general-purpose digital computer becomes a special purpose digital computer . . . which, along with the process by which it operates, may be patented subject, of course, to the requirements of novelty, utility and nonobviousness.[286]

The CONTU majority implied that a computer program itself does not constitute a patentable process.[287] The Supreme Court, however, has acknowledged patent protection for computer programs which comprise part of a larger patentable manufacturing process.[288] Nevertheless, in *Gottschalk v. Benson*,[289] patent protection was denied for a computer programmed to convert binary code decimal numbers to equivalent pure binary numbers through the use of a mathematical algorithm (as protection would result in monopolization of an abstract idea). The Supreme Court noted: "It is said that . . . [our] decision precludes a patent for any program servicing a computer. We do not so hold."[290] The Supreme Court recently quoted that passage with approval in *Diamond v. Diehr*.[291] Thus, although the Supreme Court has

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285. When programs or software are imbedded into a semiconductor chip which itself is a mechanical element of the computer, or an item of computer hardware, the integrated result is referred to as "firmware." *See* Note, *supra* note 270, at 343.

286. *In re* Prater, 415 F.2d 1393, 1403 n.29 (C.C.P.A. 1969), *modifying* 415 F.2d 1378 (C.C.P.A. 1968). *See also In re* Bernhart, 417 F.2d 1395, 1400 (C.C.P.A. 1969), in which the court stated:

> [I]f a machine is programmed in a certain new and unobvious way, it is physically different from the machine without that program; its memory elements are differently arranged. The fact that these physical changes are invisible to the eye should not tempt us to conclude that the machine has not been changed. If a new machine has not been invented, certainly a new and useful improvement . . . has been and Congress has said in 35 U.S.C. § 101 that such improvements are statutory subject matter for a patent.

See generally Moskowitz, *The Metamorphosis of Software-Related Invention Patentability*, 3 COMPUTER/L.J. 273 (1983).

287. CONTU FINAL REPORT, *supra* note 48, at 22 ("[C]opyright leads to the result that anyone is free to make a computer carry out any unpatented process, but not to misappropriate another's writing to do so.").

288. *See, e.g.*, Diamond v. Diehr, 450 U.S. 175 (1981).

289. 409 U.S. 63 (1972).

290. *Id.* at 71.

291. 450 U.S. at 187.

not yet ruled on the patentability of computer programs per se, it apparently considers programs patentable subject matter.

Before the advent of semiconductor technology, operating system programs were actually wired in computer systems.[292] In many ways, microprogramming represents state of the art hard wiring.[293] With microprogramming, object code instructions are decoded and translated into microinstructions. A number of microcode instructions combined together form a microprogram equivalent to an object code instruction. The microcode instructions are connected to control wires which either turn on or off. Thus, a program is mechanically constructed much as it was when operating systems were soldered together.

Would a hard wired operating system program, or its predecessor, the microprogram, constitute a protectable copy under copyright law? The actual physical manifestation of the program seems to have been *built*, not written. Moreover, the program seems to constitute a machine element unprotectable under copyright law as a "procedure, process, system, [or] method of operation." Yet, in such form, the program "still exists in a form from which a human-readable version may be produced . . . ."[294] The hard wired program still represents a "copy" of the original expression.

If programs which are conceived for utilitarian purposes merit copyright protection, the creator's protection of an expression should not cease because of the choice of storage medium. Similarly, that protection should not dissipate due to development of new technology which, by monitoring computer operations, could replicate the inert programming expression.

An operating system program imbedded in ROM exists to control machine functions. Metaphysical distinctions aside, it is a useful article. (perhaps not a useful article capable of and worthy of copyright protection, but a useful article nonetheless).

Copyright protection, however, was extended to computer programs because of the belief that computer programs merit protection, and copyright law provides the best means of protecting them. Many computer programs clearly represent original works of authorship.[295] Without protection, continued innovation in creative expression might cease. Of the available forms of intellectual property protection, copyright best balances the need for protection with the desire to encourage

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292. *See supra* text accompanying note 276.

293. *See generally* Patterson, *supra* note 260, at 50.

294. CONTU FINAL REPORT, *supra* note 48, at 22.

295. *Id.* at 21 ("Flow charts, source codes, and object codes are works of authorship . . . provided they are the product of sufficient intellectual labor . . . .").

competition.[296] The foregoing is also true of semiconductor chips.

Semiconductor chips and computer programs represent the result of creative efforts functionally focused. If a creative program flow chart may be copyrighted,[297] then a creative chip design flow chart should also qualify for protection. Similarly, if a program expressing the creative concept may be copyrighted, so should a design expressing equally creative semiconductor concepts; and if the program is protected when embodied in a ROM chip, the design also ought to be protected when embodied in a chip.[298] Indeed, as technology advances, the distinctions between the program and the chip diminish.

It is an axiom that copyright protects only expressions, not ideas.[299] Patent protection permits sweeping preclusion of competition, but copyright protection cannot. A copyright cannot block the independent creation of equivalents,[300] but a patent can.[301] The reduced scope of protection provided reflects the minimal standard of creativity demanded by copyright. The CONTU majority relied upon the long-established copyright doctrine barring protection of "ideas"[302] in recommending copyright protection for computer programs.[303] It was felt that the doctrine would prevent programmers from monopolizing computer language and thereby eliminating competition.[304] The idea-expression doctrine may be similarly employed with respect to semiconductors.

D. IDEA-EXPRESSION

"Unlike a patent, a copyright gives no exclusive right to the art dis-

296. *Id.* at 16-26.

297. *Id.* at 21.

298. Concern may exist as to whether a chip constitutes a copy of the original creative expression, the design. Yet, both design and program follow similar paths. Designer and programmer focus upon functional considerations and chart a path of logical operations designed to meet those constraints. Ultimately, each of their original expressions takes binary machine embodiment.

In development, a program proceeds from flow chart to source code to object code to ROM fixation. A chip in development proceeds from flow chart to design layout to mask to manufacture in silicon. The programmer initially employs linguistic symbols to record his creative expression—these are eventually translated into machine parts—and are still presumably protected by copyright. *See supra* text accompanying notes 293-94. Should the designer, who initially employs schematic symbols, be required to use linguistic symbols instead to obtain protection? In ultimate form, both are machine elements. *See supra* notes 275-86 and accompanying text.

299. Mazer v. Stein, 347 U.S. 201, 217 (1954).

300. *See supra* text accompanying note 182.

301. *See supra* text accompanying note 106.

302. *See supra* note 181.

303. *See* CONTU FINAL REPORT, *supra* note 48, at 18-20.

304. *Id.* at 20.

closed; protection is given only to the expression of the idea—not the idea itself."[305] The dichotomy between idea and expression has been incorporated into the copyright laws. Thus, although "[c]opyright protection subsists . . . in original works of authorship fixed in any tangible medium of expression," it does not "extend to any idea . . . ."[306]

No bright line separates ideas from expressions. Judge Learned Hand attempted to distinguish ideas from expressions in his famous "abstractions" test:

> Upon any work, and especially upon a play, a great number of patterns of increasing generality will fit equally well, as more and more of the incident is left out. The last may perhaps be no more than the most general statement of what the play is about, and at times might consist of only its title; but there is a point in this series of abstractions where they are no longer protected, since otherwise the playwright could prevent the use of his "ideas," to which, apart from their expression, his property is never extended.[307]

Judge Hand failed to explain how to precisely determine when the level of abstraction presented no longer constitutes protectable expression and becomes an uncopyrightable idea. Still, as one court noted: "No court or commentator . . . has been able to improve upon Judge Learned Hand's famous 'abstractions test' . . . ."[308]

The idea-expression doctrine attempts to protect an author's expression as much as possible, while allowing public access to the author's underlying idea.[309] Thus, the "guiding consideration in drawing the line [between idea and expression] is the preservation of the balance between competition and protection reflected in the patent and copyright laws."[310] The greater the number of expressions corresponding to any given idea, the broader the scope of protection afforded by copyright.[311] Hence, "[w]hen idea and expression coincide, there will be protection against nothing other than identical copying of the work."[312]

Where functional constraints direct expression, the range of available expressions necessarily narrows. Correspondingly, the possibility

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305. Mazer v. Stein, 347 U.S. 201, 217 (1954).

306. 17 U.S.C. § 102(a), (b) (1976).

307. Nichols v. Universal Pictures Co., 45 F.2d 119, 121 (2d Cir. 1930).

308. Sid & Marty Krofft Television, Inc. v. McDonald's Corp., 562 F.2d 1157, 1163 (9th Cir. 1977).

309. *See, e.g.*, Continental Casualty Co. v. Beardsley, 253 F.2d 702, 706 (2d Cir. 1958) ("[T]he proper standard of infringement is one which will protect as far as possible the copyrighted language and yet allow the free use of thought beneath the language.").

310. Herbert Rosenthal Jewelry Corp. v. Kalpakian, 446 F.2d 738, 742 (9th Cir. 1971).

311. *See Sid & Marty Krofft*, 562 F.2d at 1168 ("[T]he scope of copyright protection increases with the extent expression differs from the idea.").

312. *See* Franklin Mint Corp. v. Nat'l Wildlife Art Exch., 575 F.2d 62, 65 (3d Cir. 1978), *cert. denied*, 439 U.S. 880 (1978).

that copyright protection may preclude competition increases. For example, in *Morrissey v. Procter & Gamble Co.*,[313] the plaintiff claimed copyright infringement of his sweepstakes entry form. The entry form at issue organized contestant information, including the contestant's name, address, and telephone and social security numbers. The court observed that only a limited number of ways existed for organizing this information. Noting that an individual could easily copyright all the available expressions and thereby monopolize the field, the court denied copyright protection.

> When the uncopyrightable subject matter is very narrow, so that the topic necessarily requires if not only one form of expression, at best only a limited number, to permit copyrighting would mean that a party or parties, by copyrighting a mere handful of forms, could exhaust all possibilities of future use of the substance . . . .[314]

Similarly, copyright protection has been denied for portions of computer programs essential for basic computer operations. In *Synercom Technology, Inc. v. University Computing Co.*,[315] the court denied copyright protection for computer input formats. The plaintiff had developed a program that allowed its holders to easily employ a complicated IBM program for structural analysis. As part of its facilitative program, the plaintiff created a unique and simplified screening, sequencing, and ordering format for input data. A manual was also developed explaining the use of the new input format. In response to this program's success, defendant developed a competing computer program. The defendant not only copied the plaintiff's manual, but also copied the plaintiff's input format so that users of the first program could change to the defendant's program without complex data rearrangement. The court held that the manual constituted copyrightable subject matter. The defendant's copying therefore constituted infringement. The input formats, however, were held to constitute ideas beyond the reach of copyright protection.[316]

The *Synercom* decision reflects the balancing between protection and competition that underlies the idea-expression doctrine. Copyright for the manual protects the author's creative investment without significantly impeding competition. On the other hand, protection for the input formats would have effectively blocked competition. Indeed, the defendant developed its own program incorporating the input formats—a program exhibiting its own creative effort.[317]

Although functional considerations narrow the range of available

313. 379 F.2d 675 (1st Cir. 1967).

314. *Id.* at 676-77.

315. 462 F. Supp. 1003 (N.D. Tex. 1978).

316. *Id.* at 1012-15.

317. The *Synercom* court noted that even if the input format constituted protectible

expression, they need not preclude copyright protection. The issue in *Apple Computer, Inc. v. Franklin*[318] was the copyrightability of an operating system program embodied in ROM. Apple's microcomputer, the Apple II, enjoyed considerable commercial success. Seeking to capitalize on that success, independent software developers created programs for use with the Apple II microcomputer. The existence of this independent source of programming increased the desirability of the Apple II. Franklin developed its own competing microcomputer. To achieve compatibility with software developed for use with the Apple II, and thereby enhance the attractiveness of its computer, Franklin copied the Apple II's operating system program. Apple sued Franklin claiming copyright infringement of its operating system program.

As one of its defenses, Franklin asserted that only a limited number of ways existed for arranging operating system programs which would enable its computer to employ the broad body of existing Apple-compatible software.[319] Thus, Franklin framed the issue of idea-expression merger in a commercial context—it could only interact with Apple II compatible software by copying Apple's operating systems. The court rejected Franklin's approach. Applying a more fundamental analysis, the court observed that the functional objectives of Apple's operating system programs might be achieved without copying:

> This claim has no pertinence to either the idea/expression dichotomy or merger. The idea which may merge with the expression, thus making the copyright unavailable, is the idea which is the subject of the expression. The idea of one of the operating system programs is, for example, how to translate source code into object code. If other methods of expressing that idea are not foreclosed as a practical matter, then there is no merger. Franklin may wish to achieve total compatibility with independently developed application programs written for the Apple II, but that is a commercial and competitive objective which does not enter into the somewhat metaphysical issue of whether particular ideas and expressions have merged.[320]

The court seemed to reach the proper decision in *Apple*. Nevertheless, the court's outright refusal to examine commercial or functional considerations is questionable.

The utilitarian obstacles to copyright protection discussed in Section V(B) of this Article reflect a concern that copyright protection might be tranformed into a monopoly situation.[321] Viewing the idea-ex-

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expression, creative effort was required to design a program using designated input formats to reach a particular design analysis. *Id.* at 1013 n.5.

318. 714 F.2d 1240 (3d Cir. 1983), *cert. dismissed*, 104 U.S. 1033 (1984).

319. *Id.* at 1253.

320. *Id.*

321. *See supra* text accompanying note 230.

pression dichotomy on a continuum, the critical factor in drawing the line between the two concepts is the potential for monopolization. Examination of potential use monopolization must include commercial considerations. The court in *Apple v. Franklin* noted that numerous computer programs had been developed by independent programmers for use with the Apple II computer. In *Synercom,* the court found that commercial programming considerations led to a denial of protection for input formats. Although a variety of ways existed to input data, only by copying the plaintiff's input formats could a competing program be developed which would not require complicated data reorganization. Because the "guiding consideration in drawing the line [between idea and expression] is the preservation of the balance between competition and protection reflected in the patent copyright laws,"[322] commercial and competitive objectives merit some consideration. Further inquiry by the court in *Apple* might well have revealed a variety of ways to attain Franklin's purported objectives.

In *Synercom,* copyright protection was sought for basic operational building blocks. The input format can be analogized to simple linguistic words or phrases. Imagine an individual coining a new word, for example, "interface," and thereafter attempting to control public usage of that word through copyright.[323] Control of that word might well grant its creator protection over expressions which incorporate it but extend far beyond the boundaries it establishes, thereby unduly inhibiting competition and creativity. This was the situation in *Synercom.* In contrast, an operating system program might be considered more akin to a short

322. *Apple v. Franklin,* 714 F.2d at 1242.

323. With words, of course, monopolization of use is less threatening. Although courts have not addressed the copyrightability of words or phrases in terms of idea-expression, they have in the context of whether a work copying a phrase from another work bears "substantial similarity" to the earlier work, constituting copyright infringement. As Professor Nimmer observes:

> No easy rule of thumb can be stated as to the quantum of fragmented literal similarity permitted without crossing the line of substantial similarity. The superstition among many musicians that the copying of three bars from a musical work can never constitute an infringement is, of course, without foundation. The question in each case is whether the similarity relates to matter which constitutes a substantial portion of plaintiff's work—not whether such material constitutes a substantial portion of defendant's work. The quantitative relation of the similar material to the total material contained in plaintiff's work is certainly of importance. However, even if the similar material is quantitatively small, if it is qualitatively important the trier of fact may properly find substantial similarity. In such circumstances the defendant may not claim immunity on the ground that the infringement "is such a little one." If, however, the similarity is only as to nonessential matters, then a finding of no substantial similarity should result.

3 M. NIMMER, NIMMER ON COPYRIGHT, § 1303[A] (1984) (footnotes omitted). Where more functional considerations arise, the inquiry is more likely to focus upon the idea-expression doctrine.

story than a word or phrase. Protection of such a system would be less likely to impair competition, as suggested by the facts of *Apple v. Franklin*.

When Apple developed its Apple II microcomputer, it recognized the value of establishing a broad base of software for use with the Apple II. To encourage independent development of such software, Apple widely marketed manuals explaining and facilitating the use of its computer (a practice in which Apple still engages).[324] Inside these manuals, Apple reported the "entry points" of its operating system programs. "Entry points" mark the junction of operating system programs and applications programs—they are the designer's intended point of connection between operating system programs and application programs.

An Apple competitor, designing around these entry points, could independently develop an operating system program *largely,* but not *entirely* compatible with the body of programs independently developed for use with the Apple II.[325] Some application programs, independently created, link with the operating systems at locations other than the designer's intended interface or "entry" points. Only by duplicating the original Apple operating system programs could a competitor ensure 100% compatibility with these programs. Such programs, however, are few in number. Careful "de-bugging" of special additions to the competitor's operating system program could eliminate these losses.[326] In any event, prohibiting Franklin from copying Apple's operating system program would not seem to preclude Franklin from effectively competing with Apple.

In a similar action filed in Paris, France, Apple brought suit against another competitor, Segimex.[327] The court held that Segimex's copying of Apple's operating system program constituted copyright infringement. The court expressly noted expert testimony demonstrating that "programs having the same functions and written by different programmers present numerous variations even when they are simple . . . ."[328] Given that conclusion, the result in *Apple v. Franklin* seems sound.

The idea-expression doctrine balances the need for protection of intellectual creativity and the need for society to have free access to ideas. Where copyright for functional expression is sought, the line between idea and expression must be carefully drawn. Under such circum-

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324. Interview with Dan Wendin, Corporate Counsel, Apple Computer, Inc. (Apr. 10, 1984) [hereinafter Wendin Interview].

325. *Id.* Interviews with Gary Aka, Patent Attorney, Townsend & Townsend, San Francisco, California (Apr. 18, 1984) and Ron Yin, *supra* note 26. Telephone interviews with Robert Hinckley, and Doug Horan, *supra* note 24.

326. Wendin Interview, *supra* note 324.

327. Apple Computer, Inc. v. Segimex.

328. *Id.*

stances, as the range of available expression diminishes, the danger of use monopolization correspondingly increases. Though functional considerations, including commercial and competitive objectives, narrow the range of available expression, they need not preclude copyright protection for computer programs.

Similarly, the idea-expression doctrine need not preclude copyright protection of semiconductor chips. Problems may arise, however, where the expression sought to be protected is either too broad or too basic. For example, protection might be sought for a single element of circuit design, such as a single transistor dynamic memory cell. That cell constitutes a fundamental building block in the semiconductor industry. Thus, protection of the single transistor dynamic memory cell might preclude competition in the semiconductor industry.[329] Just as copyright does not extend to input formats or short sentence segments,[330] it should not extend to basic circuit elements, such as the single transistor dynamic memory cell.

The idea-expression doctrine should similarly preclude attempts to copyright generalized conceptual expressions such as flowcharts for semiconductor chip design, or, for that matter, for operating system programs. Such flowcharts represent generalized expression in an area where functional considerations have already narrowed the range of available expression. One might analogize such flowcharts to a chapter outline of a book. Using Judge Learned Hand's "abstractions" approach[331] such patterns seemingly embrace an area so large as to unnecessarily preclude competition. Copyright should extend hesitantly, if at all, to such expressions.[332]

Of course, as details are added to the flow chart or chapter outline, the line between idea and expression becomes increasingly blurred. In the chip design process, a schematic diagram is generated from the flow chart. This diagram symbolically sets out the various electrical components and their logical (but not spatial) relationships to one another. Eventually a mask diagram is developed which physically places each electrical component. From this diagram either a reticle or digitized tape is generated for use in chip construction. As a theoretical matter, it may be difficult to discern at which process level protectable expres-

329. *See 1983 Senate Hearing, supra* note 5, at 117 (statement of the Patent Task Force, the United States Activities Board, and the Institute of Electrical and Electronic Engineers, Inc.).

330. *See supra* notes 322-23 and accompanying text.

331. *See supra* text accompanying note 307.

332. The CONTU majority apparently felt otherwise. "Flow charts . . . are works of authorship in which copyright subsists, provided they are the product of sufficient intellectual labor. . . ." CONTU FINAL REPORT, *supra* note 48, at 21.

sion is produced. As a matter of policy, however, only the mask diagram should be protected.

As already stated, "[t]he guiding consideration in drawing the line [between idea and expression] is the preservation of the balance between competition and protection . . . ."[333] The opposing goals of competition and protection are best balanced by protecting only the mask diagram and the embodiment of its design in the semiconductor chip. A semiconductor manufacturer holding a copyright in the schematic design might monopolize a market. For example, an innovator in the semiconductor field (much as Apple was in the microcomputer field) might create a new market which in turn will attract peripheral equipment manufacturers and competitors. As a policy matter, society ought to encourage competition which will increase supply and reduce consumer costs. Such competition cannot effectively occur unless competitors can take part in the peripheral market developed for the innovator's product. Yet such functional, commercial, and competitive objections demand substantial similarity in chip design and very likely ensure that products will be nearly identical.[334] Copyright for that diagram would have too preclusive an effect upon competition, and copyright therefore ought not to be granted.

Copyright protection of schematic diagrams not only unduly inhibits competition, it also provides greater protection for semiconductor designers than is necessary. As discussed in Sections II(B) and III of this Article, the threat posed by chip pirates is identical copying; through photolithography or more advanced techniques, a pirate may disassemble an innovative product and quickly market identical copies of that

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333. *See supra* text accompanying note 310.

334. In urging a very narrow range of protection for semiconductor design, which would not preclude creation of substantially similar products, Jack Biddle declared:

> We do have one area of concern, however, which leads us to urge the subcommittee to consider adding additional language to the final bill and its legislative history that will make it clear that the revised statute will not inadvertently impair the existing rights of third parties to produce functionally equivalent chips through the design of alternative masks of their own creation.
>
> We raise this issue because the importance of interconnectivity and interoperability of the various systems and subsystems that comprise today's integrated information networks and systems becomes greater every day.
>
> In order for my computer to talk to your word processor or computer, they must be able to speak the same language, as it were. They need a means to establish communication through recognized protocols and procedures to insure that what was transmitted by one was, in fact, accurately received by the other.
>
> Without these standards, the consumer seeking compatibility between products and services is virtually forced to procure all elements of the total system from a single full-time vendor who has provided for such compatibility between its own products. Often, the logic and circuitry required to achieve this compatibility is embodied in one or more semiconductor chips.

1983 Senate Hearing, supra note 5, at 100 (testimony of Jack Biddle, President of the Computer & Communications Industry Association).

product. Indeed, industry representatives took pains to request that any protection extended to semiconductor products explicitly allow reverse-engineering to discern innovative design concepts.[335] Accordingly, there appears to be little need or demand for schematic design protection.

The final factor to consider is that the protection afforded semiconductor design should acknowledge the capabilities of the judicial system in which competing claims will be resolved. A prima facie case of copyright infringement is presented when a plaintiff demonstrates valid ownership of a copyright and copying of the protected work by the defendant. Copying may be proven by showing that the defendant had access to the protected work and that a substantial similarity exists between the defendant's work and the protected work.[336] Litigation may be expected to focus upon the issue of "substantial similarity," a highly technical matter in semiconductor design which may present perplexing problems for technically unskilled judges and juries.[337] Limiting protection to identical copying would simplify the factfinders' task. The manufacturer could further simplify the factfinders' task by including a meaningless or "dead" circuit within the depths of his chip as a trademark of sorts. This identification mark could serve as invaluable evidence of infringement, just as does the appearance of an original paper's typographical errors in a putative copy.[338]

In sum, the idea-expression doctrine does not prohibit copyright protection of semiconductor chips. As a matter of policy, however, protection should only be extended to the *final design* as expressed in mask form, recorded on digitized tape, or embodied in the semiconductor chip. Moreover, the standard for infringement of semiconductor design should be based upon whether or not the designs are identical, not upon some degree of "substantial similarity."

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335. *See supra* note 33 and accompanying text.

336. *See* Atari, Inc. v. North Am. Phillips Consumer Elec. Corp., 672 F.2d 607, 614 (7th Cir.), *cert. denied*, 459 U.S. 880 (1982).

337. To state the point from the view of copyright, even very subtle mask changes may represent significantly different designs, differences that reveal a great deal of originality . . . . We fear that devices with significantly different performance will not possess the visual differentiation of crucial features that a jury would require. The effect would be a stifling extension of copyright protection . . . .

1983 Senate Hearing, supra note 5, at 119 (statement of the Patent Task Force, the United States Activities Board and the Institute of Electrical and Electronic Engineers, Inc.).

338. For example, in Apple Computer, Inc., v. Franklin Computer Corp., 714 F.2d 1240, 1245 (3rd Cir. 1983), *cert. dismissed*, 104 U.S. 1033 (1984), the court noted that the name "James Huston," an Apple programmer, inserted in an Apple operating system program also appeared on the operating system program Franklin employed, thereby revealing identical copying. It would be difficult for a pirate to locate a carefully placed "dead circuit" without extensive examination of the chip design. Such an examination would require considerable time and effort—both of which reduce the pirate's incentive to copy.

E. THE SEMICONDUCTOR CHIP PROTECTION ACT OF 1984

On November 8, 1984, President Reagan signed into law a group of intellectual property and judicial reform measures. Included in this group of reform measures was the Chip Act which was intended to protect innovative investment in semiconductor design.

Congress chose neither patent nor copyright law to protect semiconductor chip design. In creating immediate, though limited protection for semiconductor chip design, Congress drafted sui generis legislation thematically based upon copyright law but containing some exceptions. In preceding legislative efforts, "the Senate bill accorded protection under copyright law, while the House bill established a new, freestanding form of protection."[339] The House version was adopted by both houses and eventually became law. However, as Senator Mathias noted:

> To a great extent, the difference between copyright and sui generis protection is a matter of labeling; the variations in the protection accorded chip design are not likely to be of much practical significance.
>
> . . . [B]oth bills contemplated a system of protection that closely resembles existing copyright law, with certain key deviations from that model. The Senate bill followed the copyright model while providing for stated exceptions; the House bill simply created a new legal structure patterned on copyright and incorporating similar exceptional features. The closeness to copyright of the sui generis approach may best be illustrated by the fact that many of the speakers in the House debate on chip protection referred to the House bill as a "copyright bill."[340]

The impact of the Senate version's "certain key deviations" upon copyright doctrine seems relatively limited given that protection already covers computer programs. Thus, the Senate bill explicitly provided protection for mask design as embodied in the chip itself, ignoring the utility of the chip.[341] Moreover, the Senate bill included a limited immunity for innocent infringers of rights in the chip design, and included provisions for compulsory licensing and the protection of good faith purchasers of infringing products. Special provisions also ensured that copyright of the chip design would not extend to works independently copyrighted but stored in chips. Finally, reverse engineering efforts were explicitly approved as noninfringing, and the length of protection was reduced to ten years.[342] These "deviations" are not objectionable—rather, they openly acknowledge the utilitarian nature of semiconductor chips, and tailor the scope of available protection accord-

339. Mathias-Leahy Amendment, *supra* note 161, 130 CONG. REC. NO. 129, Part II, at S12,923 (statement of Sen. Mathias).

340. *Id.*

341. *Id.*

342. *Id.*

ingly. This approach should be considered for operating system programs.

In contrast, numerous similarities exist between the Chip Act and existing copyright law. To avoid years of litigation and uncertainty concerning the new sui generis protection, copyright principles govern key areas of the new legislation.[343] Thus, the standard for protection under the Chip Act is originality,[344] and the test for infringement is "substantial similarity." Moreover, the Chip Act requires that semiconductor designs be registered with the Copyright Office. Finally, protection under the Chip Act cannot extend to "any idea, procedure, process, system, [or] method of operation . . . ."[345]

Thus, copyright principles form the foundation for the Chip Act. A unified approach to copyright that acknowledged the doctrinal change that occurred when protection extended to computer programs could have solved the problem of semiconductor design without the complications of a sui generis framework. The differences between the sui generis protection and copyright are, however, more semantic than real. The Chip Act reflects the efforts of Congress to tailor existing copyright principles to meet the demands of a new technological era.

VI. SEMICONDUCTORS IN COMMERCE: A COLLISION OF ANTITRUST, COPYRIGHT, AND PATENT LAWS?

A. THE PROBLEM

To this point this Article has focused upon the nature of intellectual property protection available for semiconductor chips. This Article asserts that to the extent semiconductor chips should be protected, copyright law is most suited for providing protection. Extending copyright protection to utilitarian articles, however, results in overlap between copyright, patent, and antitrust law. Indeed, this doctrinal overlap demonstrates the danger of extending copyright or copyright-like sui generis protection[346] to semiconductor chips and other utilitarian objects, such as computer programs, and illustrates the need for a comprehensive reconsideration of the available protection schemes.

As discussed in Section V of this Article, in considering the effectiveness of copyright protection for utilitarian articles, courts have fo-

343. *Id.* at S12,925.

344. *See* Explanatory Memorandum—Mathias-Leahy Amendment to S.1201 § III, 130 CONG. REC. No. 129, Part II, S12,917 (daily ed. Oct. 3, 1984). The Mathias-Leahy Amendment is considered part of the legislative history of the Chip Act. *See* 130 CONG. REC. No. 132, H11,609 (daily ed. Oct. 9, 1984) (statement of Rep. Kastenmeier on H. 6163).

345. 17 U.S.C. § 902(c) (Supp. III 1985).

346. In this section unless otherwise indicated, the term "copyright" refers to copyright *and* sui generis copyright-based protection.

cused on the dangers of granting monopoly protection without imposing the rigorous requirements of the patent clause. Mitigating this concern, copyright permits independent creation of equivalents, whereas patent does not. The doctrine of independent creation combines with the limit on protection where "merger" of idea-expression exists to guard against undue restriction of commerce.

The critical assumption in extending copyright protection to utilitarian articles is that the doctrine of independent creation in conjunction with the ability to narrow the scope of copyright protection does not preclude effective competition. This assumption may not sufficiently consider the realities of the marketplace. For example, suppose that substantial similarity of an article is not enough to ensure market acceptance, and that, as a practical matter, competitors *must* copy the protected article. Should this affect our willingness to extend copyright to utilitarian articles? Consider the following illustration.[347]

Competitor One (*C1*) develops a main chip, a microprocessor, and a family of chips to support it.[348] Each product exhibits sufficient creativity to merit copyright protection. Through its marketing efforts, *C1* convinces Manufacturer One (*M1*) to incorporate its chips into *M1's* operating system programs to control the interaction of the components which constitute its computer system. The structure of *M1*'s operating system programs will be dictated in large part by the design of *C1*'s family of chips.

Now assume the computer becomes well accepted by the market. As a result, a peripheral market independently mobilizes to capitalize on the computer's success. These peripheral companies produce hardware items such as printers and terminals. Programs, specifically designed to interface with the computer's operating system programs, must be developed for these hardware items to function effectively as part of the computer system. The peripheral market also includes independent software developers whose application programs are designed to interact with the computer's operating system programs. All the components, chips, programs, and supplemental hardware accessories are interdependent.

In this scenario, the computer itself, without the peripheral market, is successful. The computer's attractiveness to consumers is enhanced by the presence of the peripheral accessories. Hence, as the computer's

347. Note that this illustration considers a marketplace in which the chip developer is only engaged in competition with respect to chip manufacture and distribution. In other words, Competitor One (*C1*) is concerned with only one vertical level of competition. Concerns of competitive suppression should be considerably heightened in the case of a chip manufacturer who engages in competition across a spectrum of vertical levels.

348. *See 1983 Senate Hearing, supra* note 5, at 75-76 (statement of F. Thomas Dunlap, Jr., Corp. Counsel and Secretary, Intel Corp.).

popularity increases, the demand for peripheral services increases as well.

Competitor Two (*C2*), either reacting to *C1*'s success or concurrently developing similar articles which enter the market after *C1*'s chips, markets its own competing chips which are functionally similar, but not identical to *C1*'s chips. Therefore, *C2*'s chips resemble *C1*'s chips in size, shape, speed of operation, and storage capacity. The resemblance is intentional as *C2* hopes to exploit *C1*'s success. But can *C2* do this without identical chips? *M1* and rival computer manufacturers seeking to capitalize on *M1*'s success and exploit the existing peripheral market, are not interested in substantially similar chips; they want identical chips which ensure complete compatibility with the entire computer system.

The need for identical electronic structure is especially acute with respect to microprocessors. Microprocessors follow instructions given by operating system programs and actually control the electrical functions between connected computer components.[349] Thus, in discussing allegations that NEC had wrongfully copied the electronic structure of Intel's 8086 microprocessor (including an internal defect in the Intel chip), NEC's David Millet declared: "If you're not 100% identical, you're dead. If you take the fatal flaw out, it wouldn't be compatible. We have chosen to be as close to the original as possible."[350]

The Intel-NEC dispute highlights the overlap between chip and program. The structure that NEC faithfully copied was microcode, or the microprogramming instructions, inserted in the semiconductor substrate.[351] The microcode could be considered copyrightable programming. Otherwise, the microcode would be considered chip architecture and would constitute protectable chip design under the Chip Act. The difficulty in distinguishing between program and chip illustrates the significant advantage of a unified approach to protection.

Thus, the interdependency of computer components may render functionally equivalent, nonidentical semiconductor chips uncompetitive. As a result of the impact of external market factors, an individual possessing only copyright protection may wield patent power.[352]

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349. *See supra* text accompanying note 270.

350. Morgan, *Battling to Innovate and Emulate: Intel vs. Nippon Electric*, Washington Post, May 2, 1983, at A1, col. 1, *reprinted in 1983 Senate Hearing*, *supra* note 5, at 165.

351. *Id.* For the copier, the goal is to manufacture a chip possessing test tape identical to the originator's chip. *See supra* note 10 and accompanying text.

352. Noting the high level of interchangeability present in today's computer systems, Jack Biddle, President of the Computer & Communications Industry Association, warned:

> We would not wish to see a situation develop where a firm with a dominant market position could block competitive entry or competitor interconnection with its systems or services through the copyright protection afforded by this legislation.

In Section V(D), this Article considered the need to accommodate commercial and competitive objectives when determining both the distinction between idea and expression and the scope of protection to be afforded through copyright. This analysis raised other questions meriting consideration as well: Should the analysis consider not only commercial objectives, but also commercial conditions? Does the use of copyright protection, in the circumstances described above, exceed the scope of the grant conferred and conflict with the patent laws? How should courts analyze attempts to extend the scope of the copyright protection afforded? Finally, in the exploitation of their statutory monopolies, grantholders often offer a series of territorially exclusive licenses to a number of producers. Do the copyright or patent laws immunize such licensing or other competitively restrictive practices from antitrust scrutiny? Consideration of these questions follows.

B. PATENT LAW AS A CONSTRAINT ON COPYRIGHT EXPLOITATION

The possibility that market conditions might create patent-like power for semiconductor design protected under copyright has been examined in this Article. The question remains, however, whether there are restrictions within the copyright grant that acknowledge the distinction between patent and copyright, and that derivatively acknowledge the economic effect of granting monopoly power over useful articles to a design that has not satisfied the rigorous requirements of the patent laws. Although the evidence is unclear, it appears that Congress did not intend to limit the use of the copyright grant for semiconductor chips where market conditions create patent like preclusive power.

Representative Kastenmeier, the sponsor of H.R. 5525, declared that the legislation represented the House Committee on the Judiciary's "commitment to navigating the oft turbulent waters between '. . . the interests of authors and inventors in the control and exploitation of their writings and discoveries on the one hand, and society's competing interest in the free flow of ideas, information, and commerce on the other hand.' "[353] In his amendment to the bill, Senator Mathias de-

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. . . .

. . . For example, future situations may arise in which it is simply impossible to create alternative chip designs which are capable of performing certain interconnection or interoperability functions. If a company with substantial market power were the holder of such copyrighted designs and refused to sell or license the chip required to effectuate interconnection or interoperability, market participation by others would be blocked or severely limited.

1983 Senate Hearing, *supra* note 5, at 100 (testimony of Jack Biddle, President of the Computer & Communications Industry Association).

353. 130 CONG. REC. NO. 78, H5491 (daily ed. June 11, 1984) (statement of Rep. Kastenmeier), (quoting Sony Corp. of America v. Universal City Studios, Inc., 464 U.S. 417, 429 (1984)).

clared that "enactment of [H.R. 5525] has no preemptive or superseding effect upon other, more general legislation which may affect the semiconductor industry, e.g., unfair trade practice laws or patent laws."[354] Clearly, Congress did not intend to enact patent-like protection for semiconductor products with the passage of the Chip Act.

Indeed, H.R. 1028, the predecessor to H.R. 5525, contained a "use right provision."[355] This provision would have granted the "copyright" holder the exclusive right to "use a mask embodying the mask work to make a semiconductor chips product" and "to distribute or use a semiconductor chip product . . . ."[356] The "use right," alien to the copyright law, and resembling a patent right, elicited considerable concern in the congressional hearings.[357] That right was not included in H.R. 5525.

Nevertheless, the Chip Act contains several provisions clearly intended to acknowledge the utilitarian functions of semiconductors products. The term of protection is only ten years.[358] Reverse engineering is expressly acknowledged as a noninfringing activity.[359] An individual may reproduce a protected product to aid in an analysis of the design concepts embodied in the chip, and incorporate the results of reverse engineering efforts in a new original work.[360]

The Chip Act's explicit recognition of reverse engineering as noninfringing activity marks more than an acknowledgement by Congress of the utilitarian nature of semiconductor products. That recognition may also reflect congressional emphasis upon the misappropriation aspects of copyright law[361] and of the common law as first announced in *International News Service v. Associated Press*.[362] If so, then "slavish" copying, for whatever reasons, in response to whatever commercial realities, constitutes infringement.

Congress recognized the possibility of using compulsory licensing as a means of preventing market monopolization. In the 1909 Copyright Act, Congress specifically provided for compulsory licensing of piano

354. Explanatory Memorandum—Mathias-Leahy Amendment to S.1201, *supra* note 344, at S12,918.

355. H.R. 1028, 98th Cong., 1st Sess., 129 CONG. REC. No. 20, H643-44 (daily ed. Feb. 24, 1983).

356. *Id.* at H643.

357. *1983 Senate Hearing, supra* note 5, at 20 (testimony of Dorothy Schrader, Associate Register of Copyrights for Legal Affairs and General Counsel for the U. S. Copyright Office); *id.* at 101 (testimony of Ronald Palenski, Associate General Counsel of the Association of Data Processing Service Organizations).

358. *See* 17 U.S.C. § 904 (Supp. III 1985).

359. *Id.* § 906.

360. *Id.*

361. *See 1983 Senate Hearing, supra* note 5, at 13-14 (statement of Rep. Don Edwards).

362. 248 U.S. 215 (1918).

rolls.[363] The compulsory license provision was not enacted to penalize composers, but rather to prevent the emergence of a great musical monopoly by piano roll manufacturers.[364] Section 115 of the Copyright Act of 1976 also included compulsory licensing, though with some significant changes.[365] Indeed, the original Senate bill, S. 1201, and the original House bill, H.R. 1028, contained compulsory licensing provisions to protect innocent purchasers of infringing products.[366] These provisions were not incorporated in H.R. 5525.

Finally, Congress was careful to distinguish the legal effect of a registration certificate for semiconductor design from that of a patent certificate.[367] A design registration certificate constitutes only prima facie evidence of copyright validity,[368] rebuttable by a preponderance of the evidence, while clear and convincing evidence is required to overcome the presumption of patent validity.[369]

Congress enacted several specific safeguards to ensure that semiconductor design protection would not supersede patent protection. Absent a specific congressional declaration to the contrary, the exploration of a copyright grant with patent-like monopoly power, resulting from the interaction of external market factors, does not appear to exceed the scope of the grant intended by Congress.

C. INTERNAL CONSTRAINTS ON EXPLOITATION OF THE COPYRIGHT GRANT

Throughout this Article, the illustrative model has been highly sim-

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363. Ch. 320, § 1(e), 35 Stat. 1075 (1909).

364. *See* Shapiro, Bernstein & Co. v. Remington Records, Inc., 265 F.2d 263, 269-70 n.8 (2d Cir. 1959); Standard Music Roll Co. v. Mills, 241 F. 360, 363 (3d Cir. 1917).

365. 17 U.S.C. § 115 (1976). *See also* 2 M. NIMMER, NIMMER ON COPYRIGHT, § 8.04[c] (1984).

366. *See* H.R. 1028, *supra* note 355, § 119, 129 CONG. REC. at H644; S. 1201, 98th Cong., 1st Sess., 129 CONG. REC. No. 59, 55,991 (daily ed. May 4, 1983). In the hearings on S. 1201, Jack Biddle, President of the Computer & Communications Industry Association, concerned about interdependency of computer components requested that:

> [C]larifying language be added to confirm a party's right to reverse engineer a copyrighted chip design, and language or legislative history that makes it clear that should a chip mask embody functions that are essential to interconnection or interoperability of computers or communications equipment or systems, the copyright holder must offer to sell, license, others to manufacture, or disclose the specific details of the functions to be performed by the device, or, in the alternative, forfeit the copyright.

1983 Senate Hearing, *supra* note 5, at 100-01 (testimony of Jack Biddle, President of the Computer & Communications Industry Association).

367. Explanatory Memorandum—Mathias-Leahy Amendment to S.1201, *supra* note 344, at S12,918.

368. *Id. See also* 17 U.S.C. § 908(f) (Supp. 1985).

369. Explanatory Memorandum—Mathias-Leahy Amendment to S.1201, *supra* note 344, at S12,918.

plistic for it has assumed that a single item protected by copyright will enter the stream of commerce alone. In reality, such marketing rarely occurs. Commercial products frequently integrate private (i.e., copyrighted or patented) components with other private or public components. A semiconductor chip may contain elements of a design which has previously been copyrighted, or even patented. Moreover, the semiconductor manufacturer may condition sale of the integrated item upon purchase of other unprotected items. Such arrangements may further extend the power of the grantholder over commerce, and are particularly detrimental in a highly interdependent industry such as the market for computer systems. It is not clear to what extent internal constraints within the copyright grant limit these integration and tying practices.

1. *Articles of Commerce—Limitations on the Exploitation of a Protected Component?*

As a threshold matter, no antitrust or statutory scope concerns arise where the article of commerce incorporates concepts within the public domain. No harm results from the manufacturer's use of the idea or concept in connection with the protected component, because all competitors are equally free to use the idea with their own components. No restriction on public access exists.

Different concerns arise where private components protected through copyright or patent are combined with other private components. By exploiting private components in various combinations, the grantholder might obtain a greater reward than would otherwise be possible through individual exploitation. The grantholder, however, cannot exploit the component without restriction. The statutory grants bestow no absolute monopoly upon grantholders. As the Supreme Court stated in *Kendall v. Winsor*,[370] "It is undeniably true that the limited and temporary monopoly granted to inventors was never designed for their exclusive profit or advantage; the benefit to the public or community at large was another and doubtless the primary object in granting and securing that monopoly."[371]

The point at which exploitation exceeds that contemplated by the statutory scheme of the grant is an inquiry without a simple resolution. It cannot be behaviorally described, but rather must be structurally determined. The analysis must focus upon competition, and because efforts to enhance competition through the combination of private components is desirable, attempts to suppress competition through the

370. 62 U.S. (21 How.) 322, (1859).

371. *Id.* at 327-28. *See also* Mazer v. Stein, 347 U.S. 201, 219 (1954) (similar considerations underlie the copyright grant).

combination of private components should be considered to violate the policies underlying statutory intellectual property grants.

Principles derived from common law actions for unfair competition, for example, the tort of interference with contractual relations, and from the federal antitrust laws,[372] may define the scope of permissible exploitation practices.[373] The techniques of analyzing competitive conduct found in court decisions applying federal antitrust law are useful. Although principles derived from antitrust law define the scope of permissible copyright exploitation practices, actual antitrust violations should not be required for a finding of copyright misuse.[374]

Consider the following illustration. *C1* designs and constructs semiconductor chips which it incorporates into its own personal computer. *C1* does not possess the ability to control prices or exclude competition in either the semiconductor or personal computer market. *C1*'s chip and computer design are state of the art, but not revolutionary technology because several other companies offer similar technology. As an accessory to its basic personal computer, *C1* sells a graphic display terminal which is also composed of its own chips.

C2 operates in a smaller commercial arena than *C1*. *C2* develops and constructs chips which it uses in its own graphics display terminal. This terminal is designed to supplement basic personal computers, including *C1*'s. Through specialization, *C2* is able to market a superior product at a lower cost to the public.

To prevent *C2*'s product from diverting sales from *C1*'s graphics display terminal, *C1* arranges the configuration of its protected components to allow only *complete* compatibility between its personal computer and its video display terminal. Despite *C1*'s efforts to protect its accessory product, a substantial number of consumers purchase *C2*'s product. *C2* desires complete compatibility with *C1*'s product, and therefore copies protected components of *C1*'s product. *C1* files an infringement action against *C2*.

The statutory protection scheme does not automatically forbid the combination of private components or efforts to maximize the reward

372. Sherman Act, 15 U.S.C. §§ 1-7 (1982); Clayton Act, *id.* §§ 12-27; Robinson-Patman Act, *id.* §§ 13-13b, 21a; Federal Trade Commission Act, *id.* §§ 41-58 (Section 1 of the Clayton Act specifically defines the Sherman, Clayton, and Robinson-Patman Acts as "antitrust laws"; the Federal Trade Commission Act is not specifically defined as such. *Id.* § 12.).

373. For a persuasive and thorough discussion of this subject, see Gibbs, *Copyright Misuse: Thirty Years Waiting for the Other Shoe*, 23 COPYRIGHT L. SYMP. (ASCAP) 31 (1977); Comment, *Convergence of the Copyright Law and the Sherman Act*, 51 MISS. L. J. 79 (1980); Fine, *Misuse and Antitrust Defenses to Copyright Infringement Actions*, 17 HASTINGS L. J. 315 (1965).

374. *See generally* Gibbs, *supra* note 373.

received from the grant. Nor do the circumstances warrant federal antitrust scrutiny. *C1* does not possess market power,[375] and no *dangerous possibility* exists that *C1* may obtain such power through its conduct.[376] Nevertheless, market power considerations need not influence our examination of exploitation practices. The intellectual property laws grant limited monopolies to stimulate creation and thereby benefit the public. Where the monopoly is employed solely or perhaps even primarily to suppress competition, the public is not benefitted and may indeed suffer considerable harm. Consequently, the grantholder's statutory protections should end. *C1* should forfeit its ability to prevent infringement by *C2*.

Compare the following situation. *C1* combines its already protected components in an unusual manner which revolutionizes the personal computer field (but does not qualify for patent protection). *C1*'s configuration renders all existing accessories for its personal computer obsolete. Moreover, *C1* markets a graphics display terminal employing additional protected components for use with its new personal computer. *C2*'s product is not capable of compatibility with *C1*'s new personal computer. Rather than develop a new product to work with the new personal computer, *C2* chooses to copy *C1*'s graphics display terminal. *C1* sues for infringement.

Under these circumstances, no "misuse" of the statutory monopoly exists. Indeed, the development of *C1*'s revolutionary new personal computer has opened up a new competitive market for peripheral accessories. No bar to *C1*'s infringement action should exist.

Only careful consideration of the commercial consequences of the product's introduction and of the manner of exploitation reveals the proper analysis in an infringement action. Antitrust decisions supply valuable principles for defining the scope of permissible exploitative conduct. Unfortunately, these restrictions upon the exploitation of the copyright grant may not apply to the exploitation of semiconductor design protected by the copyright-based law of the Chip Act.

2. *Attempts To Tie the Sale of Protected Articles with Staple Goods in Commerce*

Only the commercial exploitation of private components combined with other private components has been discussed so far in this Article. Private components are articles to which the public enjoys limited access. Public components, in contrast, are readily available to the public,

375. *See generally* L. SULLIVAN, ANTITRUST § 7 (1977) (Market power, the ability to control prices or exclude competition, must be shown to prove a violation of § 2 of the Sherman Act.).

376. *See* Swift & Co. v. United States, 196 U.S. 375, 396 (1905).

their distribution subject only to restrictions imposed by the marketplace. Other restrictions reducing access to articles in the public domain should only be allowed reluctantly. This reluctance should be evident where the restrictions are implemented through the use of a statutory grant, awarded to promote public welfare. Attempts by the grantholder to condition the sale of statutorily protected articles upon the buyer's agreement to purchase unprotected public articles ought to be viewed with disfavor.

The Supreme Court's decision in *Dawson Chemical Co. v. Rohm and Haas Co.*,[377] demonstrates the statutorily imposed policy against efforts to exploit the federal patent grant. In the late 1950's, propanil, a chemical compound first created in the early 1900's, was discovered to have herbicidal qualities. Attempts to patent the compound as a herbicide failed. Subsequently, Rohm & Haas patented a method of applying the compound to crops. Rohm & Haas would only issue licenses to use its patented process to those agreeing to purchase propanil from Rohm & Haas. Dawson Chemical Company manufactured propanil which had virtually no herbicidal value without the patented process. After unsuccessfully requesting a license for the process, Dawson marketed propanil in containers with printed directions describing the patented Rohm & Haas process for the use of the compound. In the ensuing contributory infringement action, Dawson claimed that the commercial licensing practices of Rohm & Haas constituted an attempt, through the means of a "tying" arrangement, to effect a monopoly over an unpatented component of the process. The Supreme Court rejected the claim of patent misuse.

In an earlier decision, *Mercoid Corp. v. Mid-Continent Inv. Co. (Mercoid I)*,[378] the Supreme Court reviewed a similar factual situation. In *Mercoid I,* however, the Court denied relief to the patentee and held that its licensing arrangement constituted an unlawful attempt to extend the patent monopoly. The Court stated:

> The necessities or convenience of the patentee do not justify any use of the monopoly of the patent to create another monopoly. The fact that the patentee has the power to refuse a license does not enable him to enlarge the monopoly of the patent by the expedient of attaching conditions to its use.[379]

In 1952, Congress codified the patent laws to replace the general judicial rules which governed the doctrines of contributory infringement and patent misuse.[380] In *Dawson Chemical,* the Court observed that section 271(c) expressly declared that the sale of a nonstaple article (an

377. 448 U.S. 176 (1980).

378. 320 U.S. 661 (1944).

379. *Id.* at 666.

380. 35 U.S.C. § 271 (1954); *Dawson Chemical,* 448 U.S. at 180-81.

article with no commercial use except in connection with the patented item) constituted contributory infringement.[381] Accordingly, resort to the doctrine of patent misuse was no longer required to prevent patentee control over staple goods used in their inventions.[382]

Observing that section 271(d) expressly permits the patentee to derive revenue from acts that "would constitute contributory infringement" if "performed by another without his consent," the Court noted:

> [T]he provisions of § 271(d) effectively confer upon the patentee, as a lawful adjunct of his patent rights, a limited power to exclude others from competition in nonstaple goods. A patentee may sell a nonstaple article himself while enjoining others from marketing that same good without his authorization. By doing so, he is able to eliminate competitors and thereby to control the market for that product.[383]

Because the Court based its decision in *Dawson Chemical* largely upon the enactment of section 271, and because no analogous provision exists in the copyright laws, attempts to link exploitation of the copyright articles with nonstaple (and staple) goods seem to constitute copyright misuse. The Supreme Court has, however, rejected such a conclusion. In *Sony Corp. of America v. Universal City Studios,*[384] the Court relied upon the "historic kinship between patent law and copyright law" and applied the "staple-nonstaple" distinction articulated[385] in *Dawson Chemical.* The Court held that the sale of video tape records (VTR's) did not infringe upon copyrighted television programs. The Court observed:

> The staple article of commerce doctrine must strike a balance between a copyright holder's legitimate demand for effective—not merely symbolic—protection of the statutory monopoly, and the rights of others freely to engage in substantially unrelated areas of commerce. Accordingly, the sale of copying equipment, like the sale of other articles of commerce, does not constitute contributory infringement if the product is widely used for legitimate, unobjectionable purposes. Indeed, it need merely be capable of substantial noninfringing uses.[386]

Therefore, the patent and copyright laws provide the grantholder a monopoly over nonstaple goods intended solely for use in conjunction with the protected article. Control of the staple market through the power afforded by the statutory monopoly, however, is impermissible. Arguably, no such limitations attach to the exploitation of the monopoly granted by the Chip Act.

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381. *Dawson Chemical,* 448 U.S. at 200.

382. *Id.* at 200-01.

383. *Id.* at 201.

384. 464 U.S. 417 (1984).

385. *Id.* at 439-42.

386. *Id.* at 442.

The Chip Act states that "the distribution or importation of a product *incorporating* a semiconductor chip product as a part thereof is a distribution or importation of that semiconductor chip product."[387] Thus, the owner of a protected semiconductor chip might extend the boundaries of the monopoly by incorporating the protected product within a larger article, such as a computer or a video display terminal. Although the protected component might constitute a minute portion of the commercial product, competitors could not copy the otherwise unprotected product without removing the offending component. Imitation without such removal would constitute infringement.[388] Clever engineering by the grantholder might render such removal prohibitively expensive, if not impossible.

Read strictly, the Chip Act seems to authorize exploitation practices prohibited under section 271(D) of the patent laws. Yet, as already discussed in Section VI(B) of this Article, Congress was careful to ensure that semiconductor design protection would not have the preclusive power of patent laws. Considering the Chip Act's legislative history, a narrower construction of infringing behavior seems justified; courts could infer constraints on the exploitation of protected semiconductor products as discussed with respect to the copyright grant in Section IV(C) of this Article.

No harm results when the holder of a protected semiconductor product exercises control over nonstaple goods which hold commercial value only in conjunction with the protected article. The statutory grant should confer its holder a limited power of the nonstaple market, but no such power should be afforded the grantholder over the staple market.

Attempts to suppress competition through the sale of an exclusive package of protected and unprotected components, whether through product integration techniques or tying practices, violates the purposes underlying the statutory grant of protection. Those who misuse the statutory monopoly granted to them should be required to forfeit their ability to prohibit infringement.

D. The Conflict Between Intellectual Property and Antitrust Laws

This Article has discussed the existence of internal procompetitive constraints within the intellectual property grants, and their impact upon effects to increase the scope of a statutory monopoly. The potential conflict between the federal intellectual property and antitrust laws has not yet been considered.

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387. 17 U.S.C. § 901(b) (Supp. III 1985) (emphasis added).

388. *See id.* §§ 901, 905.

Recall the first hypothetical scenario.[389] In that scenario, a competitor developed a family of semiconductor chips protected by copyright which obtained patent-like power through the operation of external market forces. To illustrate the possible operation of internal procompetitive policy constraints, no federal antitrust violation was presented in the hypothetical. Internal statutory policies restricted exploitative conduct, but external statutory policies did not.

Imagine that the grantholder intends to exploit the protected creation through a division of territories among the licensees. Assume further that such territorial divisions are not prohibited by internal procompetitive policies within the grant itself. Also assume that the federal antitrust laws forbid territorial divisions as unduly anticompetitive. Based on these facts, consider the resulting conflict between the federal intellectual property and antitrust laws.[390]

No hierarchy exists between the two schemes.[391] The "field approach" suggests that the conflict be resolved by examining the strength of each regime's interest in the particular factual setting.[392]

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389. *See supra* text accompanying notes 347-52.

390. A conflict might also be presented in a situation where both statutory schemes prohibit the conduct at issue. For example, reconsider the second scenario. *See supra* text accompanying notes 375-76. In that illustration, *C1's* component combinations, while constituting copyright misuse, would escape statutory antitrust scrutiny because *C1* lacked market power. Imagine instead that *C1* possesses sufficient market power to trigger such scrutiny. The question would then become which scheme's remedy and/or liability procedure should be imposed. Consider whether a party infringing *C1's* grant should be permitted to claim copyright misuse as a defense to infringement and claim antitrust damages as well.

391. *See* L. SULLIVAN, *supra* note 375, § 184(c).

392. *See* Buxbaum, *Restrictions Inherent in the Patent Monopoly: A Comparative Critique*, 113 U. PA. L. REV. 633 (1965). *See also* Kaplow, *supra* note 104, at 1815. Professor Kaplow has characterized "field" analysis as an approach which resolves the antitrust-patent law conflict by invoking formalistic constructions that are indeterminate and only superficially address the issues at stake. Although Professor Kaplow's criticisms bear equally upon the antitrust-copyright conflict, a detailed critique of his article is beyond the scope of this Article. Nevertheless, a brief summary of his criticism follows.

Professor Kaplow notes that the patent laws regulate three factors. Patent law establishes patent life which (1) determines the patentee's reward; (2) encourages innovation; and (3) results in social benefit. *Id.* at 1832. Optimal patent life occurs where the marginal social cost of lengthening or shortening patent life equals the marginal social benefit. *Id.* at 1829. Kaplow suggests that the breadth and scope of patent protection might be adjusted to optimize social benefit. *Id.* at 1819, n.17.

Professor Kaplow does not address what practices lie "inherent in the patent monopoly" and criticizes those engaging in such analysis. *Id.* at 1848-49. Still, Kaplow's marginal cost-benefit analysis represents a model system of innovative incentive, not an accommodation of competing federal antitrust and intellectual property policies because the length and breadth of protection constitute inherent features of patent protection. Otherwise, the distinctions between the copyright and patent regimes would disappear and be replaced by an integrated system of reward for innovation. Although an admirable result, it

This determination, which seems to balance the innovativeness of the product against the potentially anticompetitive practices pursued in its exploitation, may prove difficult under our facts. *C1* has developed a revolutionary product. If the antitrust laws consistently condemn territorial divisions, how then should the balance be drawn?

The field approach may raise more questions than it answers, primarily because its factual emphasis diminishes its utility as a general analytic guide. Nevertheless, where problems of statutory overlap or conflict arise, an analytic inquiry into the purpose and scope of each statutory scheme seems inescapable in the absence of explicit congressional resolution of the conflict.

VII. CONCLUSION

Semiconductor chips play an indispensable role in modern technology, performing electronic functions in a variety of settings. The widespread use of semiconductor chips has made them inviting targets for duplication by chip pirates. As a result of chip piracy, industry representatives lobbied heavily for intellectual property protection.

Despite widespread copying by chip pirates, several reasons exist for doubting the wisdom of such protection. Copying, or "developing," alternative sources of supply is essential to a market economy. Protection of goods tends to reduce competition and thus should be extended sparingly. In contrast, it is argued that innovation will diminish without protection of the required intellectual investment. The nature of semiconductor technology, however, may afford sufficient safeguards for this required intellectual investment.

Innovation in the semiconductor industry occurs at a startling rate, largely because semiconductor products enjoy relatively short lifetimes. The initial creator's lead time alone may ensure sufficient investment return to encourage continued innovation. As semiconductor manufacturing technology advances, so too must chip copying methods. The result is that chip piracy becomes more speculative, more time consuming, more expensive, and therefore less lucrative as semiconductor manufacturing technology advances. Furthermore, many experts have directly attributed the rapid rate of innovation in the semiconductor industry to the easy accessibility of ideas within the field. Protection may restrict information flow, thereby diminishing industry innovation.

If, however, it is considered necessary to safeguard semiconductor

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would hardly reflect current intellectual property law. Once one acknowledges that certain features, such as the length and breadth of protection, lie inherently within the statutory grant, the door is opened for the investigation of the existence of other inherent rights. Despite Kaplow's protestations, some determination of what practices lie "inherent" in the patent (or copyright) monopoly seems inescapable.

design, copyright law provides the best framework for protection. Copyright protection attaches swiftly and thereby preserves the creator's most precious asset: lead time. Although copyright prohibits copying by chip pirates, it does not prohibit independent creation of equivalents. Thus, copyright protects the creative expression of the innovator without blocking the use of the idea from which it arose. This is an important feature in the semiconductor industry, an industry in which technology must be shared. Moreover, the term "writings" in the patent and copyright clause of the Constitution is sufficiently broad to embrace semiconductor design.

Nonetheless, doctrinal barriers currently prohibit protection of utilitarian objects through copyright law. This prohibition reflects concern that extending copyright protection to useful articles would usurp the province of patent law. Copyright law, however, affords far less preclusive protection than does patent law. Copyright protection cannot bar independent creation of equivalents, nor can it monopolize an idea or functional process. Patent protection may do both. Moreover, by narrowing the range of protection afforded semiconductor design and prohibiting only identical copying, the anticompetitive impact of copyright may be minimized. Considering these factors, copyright law affords additional, not conflicting, innovation incentives to those already promoted by the patent laws. Thus, copyright protection for utilitarian objects should not be preempted by the patent laws.

Indeed, Congress has extended copyright protection to computer programs, including operating system programs. Operating system programs exist to control computer electrical functions, and are therefore utilitarian. Moreover, such programs are often stored in or imbedded in semiconductor chips. Technological advances have thereby blurred the distinctions between chips and programs.

Congress could have protected semiconductor chips through copyright and openly acknowledged the doctrinal changes in copyright that would apply when protection extended to computer programs. Instead, Congress enacted sui generis protection for semiconductor design although the differences between this sui generis protection and copyright law are relatively few.

Copyright principles form the foundation for the sui generis protection. Departures from copyright law in the new statutory scheme limit the scope of protection afforded utilitarian articles and ensure that patent power is not bestowed upon articles demonstrating only minimal inventiveness. The Chip Act offers semiconductor design significantly shorter protection than would be available under copyright. Further, the Chip Act specifically sanctions reverse engineering as permissible, noninfringing conduct. Admittedly, such restrictions could also apply to computer operating system programs. Congress' failure to stipulate to

this application should not detract from its efforts to tailor existing copyright principles to meet the demands of a new technological area.

Although Congress was careful to restrict the scope of protection afforded under copyright or copyright-based law, and avoid encroachment on the patent regime, external market forces may inadvertently bestow patent-like preclusive power to articles only copyrighted. Despite the suggestions of some semiconductor industry representatives, Congress included no compulsory licensing provisions which would restrict the exploitation of the statutory grant under such circumstances.

As a practical matter, protected articles rarely enter commerce individually. Manufacturers often market articles composed of many different individually protected components, or condition the sale of protected articles upon the buyer's agreement to purchase unprotected articles from the manufacturer. When used in combination, protected components may suppress competition to a greater extent than when they are separately marketed. The anticompetitive danger posed seems particularly acute in a highly interdependent field such as the computer systems market. Nevertheless, internal antitrust constraints within the patent and copyright grants may prohibit such anticompetitive conduct and prevent abuse of the statutory grants. Although the Chip Act's sui generis protection arguably permits combination practices prohibited under copyright and patent law, courts should infer internal constraints, similar to those found under the other two protection schemes, if faced with the exploitation of protected semiconductor design.

A direct statutory conflict may be posed where no internal constraints within the statutory grant prohibit a particular exploitation practice that the federal antitrust laws consistently condemn. In that instance, the interests of the competing statutory policies in the particular factual setting must be examined and balanced until Congress provides further statutory guidance in this area.