COPYRIGHT PROTECTION FOR SEMICONDUCTOR CHIPS

HEARINGS

BEFORE THE

SUBCOMMITTEE ON COURTS, CIVIL LIBERTIES, AND THE ADMINISTRATION OF JUSTICE

OF THE

COMMITTEE ON THE JUDICIARY
HOUSE OF REPRESENTATIVES

NINETY-EIGHTH CONGRESS

FIRST SESSION

ON

H.R. 1028

COPYRIGHT PROTECTION FOR SEMICONDUCTOR CHIPS

AUGUST 3 AND DECEMBER 1, 1983

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COPYRIGHT PROTECTION FOR SEMICONDUCTOR CHIPS

WEDNESDAY, AUGUST 3, 1983

House of Representatives,
Subcommittee on Courts, Civil Liberties
and the Administration of Justice,
Committee on the Judiciary,
Washington, D.C.

The subcommittee met at 9:30 a.m. in room 2226 of the Rayburn House Office Building; Hon. Robert W. Kastenmeier (chairman of the subcommittee) presiding.

Present: Representatives Kastenmeier, Synar, Schroeder, Frank, Hyde, Kindness, and Sawyer.

Staff present: Michael J. Remington, chief counsel; Deborah Leavy, counsel; and Joseph V. Wolfe, associate counsel.

Mr. Kastenmeier. Please come to order.

We are gathered here today to consider the extension of the Copyright Act for the protection of semiconductor chips and masks from unauthorized duplication.

Before introducing our initial panel of congressional witnesses, I would like to make a brief introductory statement.

Two weeks ago the subcommittee inaugurated a series of oversight hearings on copyright and technological change. During those hearings, which will continue throughout the 98th Congress, we learned that we as a society are entering a new age. We are rapidly changing from an industrial to an informational society. Ever-expanding technologies, from computers to satellites to silicon chips to cable television, insure that the use and processing of information will be a key resource in the future. One might even call the information the "new capital."

The problems that that change creates for our legal system, which of course has to deal with the ceaseless flux in as rational way as possible, are obvious. I am not even sure how to define the role of law in confronting change. Is the role of law to organize and redirect changes that started outside the law? Or is it to predict and stimulate change? Can law create new rights without negatively impacting on old rights?

These are difficult questions. We do know that all changes in our society are subjected to the bedrock principles that are found in our Constitution. As pertains to copyright, the founders of this Nation recognized the need to define rights and creations which arise purely out of human intellect. Conferred on Congress was the power to promote the progress of science and the useful arts by securing for limited times to authors and inventors the exclusive right to their writings and discoveries.

One of the issues before us is whether the bill in question, H.R. 1028, falls within that power.

In brief, H.R. 1028 creates a new kind of copyrightable work, a "mask work."

At this point, without objection, I would insert a copy of the bill into the hearing record. (A copy of H.R. 1028 appears at p. 489, app. 4.) I will defer to the congressional sponsors for a further explanation of the proposed legislation.

Before introducing these sponsors, I would like to note for the record that this hearing is a sequel to a hearing held in the spring of 1979 during the 96th Congress.

At that hearing held in San Jose, Calif., we discovered that a previously assumed consensus in support of the then-proposed legislation did not in fact exist. So we look forward to hearing what changes have been made in respect to that previous proposal, and are incorporated in the present bill.

With these thoughts in mind, I would now like to call forward our introductory panel of witnesses: Congressman Don Edwards and Congressman Norman Mineta. These two respected Members represent the area commonly known and referred to as Silicon Valley. Don Edwards is a highly respected Member of the Committee on the Judiciary and the chief sponsor of the legislation before us. He also is a dear friend.

Norm Mineta, former mayor of San Jose and a respected member of the Science and Technology Committee, is an original sponsor and longstanding supporter of the legislation.

You might call our two witnesses in-house witnesses.

Gentlemen, before asking you to proceed, I would also note that we have received a statement from Senator Charles McC. Mathias, Jr., who chairs our sister subcommittee in the Senate. And we would, without objection, accept that statement and make it part of the record.

[The complete statement of Charles McC. Mathias follows:]

PREPARED STATEMENT OF SENATOR CHARLES McC. MATHIAS, JR.

Chairman Kastenmeier, and members of the subcommittee, thank you for this opportunity to submit my comments on H.R. 1028, the Semiconductor Chip Protection Act of 1983. As you know, I have introduced a similar bill, S. 1201, in the Senate.

First, let me commend you for holding this hearing in the issue of copyright protection for semiconductor chip design. The questions which will be discussed here today are important ones for the U.S. high technology effort in general, and for the semiconductor industry in particular. These questions don't have simple answers; but they demand our immediate attention. If we shrink from the complexity of the task before us, we may some day find that it's too late to begin. For that reason, I'm particularly pleased to see the House take up this essential legislation. This hearing reinforces my optimistic view that we may be able to enact chip protection legislation into law during the 98th Congress.

Mr. Chairman, the semiconductor chip is revolutionizing the way we live today—the way we learn, the way we relax, the way we do business. This quarter-inch square of silicon is our newest breed of computer, which works harder and faster, with fewer breakdowns and less energy consumption, than its predecessors of a few decades or even a few years ago. And this greatly enhanced calculating power is available at a fraction of the cost of earlier computers.

When we marvel at the wonders of modern technology, it's usually the work of the chip we're admiring. The microprocessor, the "computer on a chip," has made many of our modern day conveniences possible. The chip is in the home, making dinner in the microwave over, setting the thermostat and tuning the radio; it's in the supermarket, adding up our purchases; it's in the car, controlling fuel consumption; it's in the hospital, helping doctors diagnose disease; it's in the schools, instructing our children; and it's in the office, doing the typing, the record-keeping, and almost everything else.

Chip designs are constantly being upgraded and refined. Every year engineers double the number of components they can fit on a chip. By 1990, they hope to squeeze ten million transistors into a single chip. As chips increase in complexity, we will find more and more way to use them. Some of these uses are already in the experimental stage; others are still in the realm of science fiction, and others are as yet unimagined.

But our progress toward these technological wonders may be delayed or frustrated if something isn't done to protect the products of innovative chip designers from piracy and theft.

High tech firms spend huge amount of time and money on producing semiconductor chips. Engineers design intricate layouts of circuitry analogous to the architect's blueprint. Like the architect, the chip designer must find the most elegant solution to a specified set of needs and problems. Concentrating hundreds of thousands of transistors into such a tiny space is in itself no easy task; the real challenge is in finding ways to maximize and diversify the electronic possibilities of the transistors.

As you will hear today, chip production is a fine and costly art. The design for the tiny chip is first laid out in a plan many feet square; then, small photographic "masks" are prepared, from which the image is transferred onto a silicon wafer, usually by a process similar to silk-screening. Several layers like these are built up, and the chip is born. The entire procedure—from conception to completion of the chip—can take the innovating firm years, consuming millions of dollars and thousands of hours of the engineers' and technicians' time.

Yet, these innovators are being ripped-off by onshore and offshore "chip pirates," who, for a fraction of the developers' cost, can now legally appropriate and use these chip designs as their own. All they need do is buy a computer or other device on the open market, remove its chips, scrape off the protective plastic coating, photograph the circuitry, enlarge these photographs and copy the designs in order to produce their own masks and thus their own chips. Then, the pirate firm can flood the market with cheap products. It can sell its products cheaply because it makes them cheaply—after all, the innovating firm already paid the R&D costs. The high tech pirate, like any other, catches a free ride on the creativity, financial investment, and hard work of others.

That is why H.R. 1028 is so important. Current law gives only very limited protection to semiconductor chips. Patent law can protect the basic electronic circuitry used in the chip, but not its carefully developed design. By giving chip engineers and manufacturers copyright protection for a 10 year period, H.R. 1028 will protect their R&D investment. It will also protect innocent purchasers of pirated chips, by including a compulsory licensing provision allowing them to use that chip after paying a royalty to the innovating firm, thus eliminating any liability for innocent infringement.

I urge all the members of this subcommittee to give prompt and serious attention to this thoughtful proposal. In the Senate, the Subcommittee on Patents, Copyrights and Trademarks held a fascinating hearing on S. 1201, the companion measure to the bill before you. As a result of several constructive suggestions made at that hearing, we have incorporated some improvements into our bill, and we hope to see subcommittee action on it in the near future.

Finally, Mr. Chairman, I would like to commend Representative Edwards and Representative Mineta for the leadership that they have shown on this important issue. Four years ago, these two legislators introduced the first bill to give copyright protection to semiconductor chip design. The measure before you today is the direct descendant of that original initiative. It is a proposal which would, if adopted, expand the frontiers of the copyright law, while remaining true to the constitutional injunction on which all our intellectual property laws are based: to "promote the Progress of Science and Useful Arts."

The ingenuity of an age that has produced a tool as remarkable as the computer chip should be able to devise laws adequate to protect it. As Thomas Jefferson so wisely observed in our nation's infancy:

". . . (L)aws and institutions must go hand in hand with the progress of the human mind . . . As new discoveries are made . . . institutions must advance also, and keep pace with the times."

Mr. KASTENMEIER. So, Congressman Edwards and Congressman Mineta, you may proceed as you wish.

TESTIMONY OF HON. DON EDWARDS, A U.S. REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. EDWARDS. Well, thank you very much, Mr. Chairman, and thanks to the other members of the subcommittee for having this important hearing. Mr. Mineta and I and others from our part of the country feel that the passage of this legislation is critical to our Nation's continued leadership in the semiconductor field.

As I believe you pointed out, Mr. Chairman, the current laws do not give protection to the designs of semiconductors, and this is an open invitation to piracy. This bill sponsored by Mr. Mineta and me and our colleague from the same area, Ed Zschau, grants copyright protection and gives legal protection against piracy.

It also protects other firms by immunizing innocent infringers. And that is a new part of the bill since 1979 and assures compulsory reasonable royalty licenses, which is very important too, and also assures the right of others to use the designs for appropriate reverse engineering.

Mr. Chairman, there is no cost in this legislation. No new bureaucracy is created. There is unanimous support in the industry, the semiconductor industry, of this legislation. And I know of no substantial opposition, unlike our problem in 1979 where the industry engaged in semiconductor work were divided.

In summary, Mr. Chairman, the bill closes the gap in the current law. I believe it is a good law. There is an urgent need for its enactment. And I thank you very much for hearing me today. And I ask unanimous consent that if the article from the National Geographic has not already been printed in the record, it would be a useful addition to the record.

[The complete statement follows:]

PREPARED STATEMENT OF DON EDWARDS

I thank the distinguished Chairman and other members of this Subcommittee for holding hearings today on H.R. 1028, "The Semiconductor Chip Protection Act of 1983". As sponsor of this legislation, along with Congressman Mineta, Congressman Zschau, and others of our colleagues, I believe that passage of H.R. 1028 is critical to our country's continued leadership in the semiconductor field.

Because of the rapid change inherent in new technologies, protecting rights to those technologies can be very difficult. Current law fails to provide that protection to semiconductor chip innovations. In 1979, Mr. Chairman, you noted:

"There are many designs which are original but do not meet the standard of novelty required for patent protection and are also not eligible for copyright protection because they are not purely ornamental. The designs of circuits used in small computer devices fall within this unprotectable category."

Since current laws do not give protection to semiconductor designs, chip innovations by one firm are subject to piracy by other firms. 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. This, of course, has a ripple effect throughout our economy, with the impact becoming ever more critical as we continue an accelerated transition to a high-tech society.

H.R. 1028 will amend Section 101 of the Copyright Act of 1976 to grant copyright protection for the imprinted design patterns on semiconductor chips, thus giving innovating semiconductor firms legal protection against the pirating firms. If enacted into law, the bill will give semiconductor firms the needed incentives to invest in research and development, by protecting them against the piracy of the results of that research and development. The bill also protects the legitimate interests of other firms by immunizing innocent infringers, assuring compulsory, reasonable royalty license when needed and justified, and assuring the right to the practice of reverse engineering for the purposes of teaching, analysis, or evaluation.

There is no administrative cost associated with the bill nor is there cost in lost tax revenue. No new bureaucracy is needed. In addition, the bill has the unanimous support of the affected industry and, to my knowledge, has no substantial opposition.

In summary, this proposed legislation will close a gap in our current copyright law. I believe it is a balanced, reasonable proposal, with due concern for the legitimate interests of chip designers and of chip users. I commend this Subcommittee for holding this hearing on this important measure. I ask permission to include in the record of the hearing my statement with a section-by-section analysis which appeared in the Congressional Record on February 24, 1983, and an article on semiconductor chips that appeared in the October, 1982, issue of the National Geographic. I look forward to the testimony of your expert witnesses and to your work on the bill. It has been my pleasure to have the opportunity to share my views with you.

Mr. KASTENMEIER. Does each member have the National Geographic article at his or her place? Then without objection, the text of the article will be reprinted in the appendix to this hearing. (See app. 2 at p. 355.)

Mr. EDWARDS. Thank you.

Mr. KASTENMEIER. I might also say that your colleague from the same area, Congressman Ed Zschau, was not able to make this hearing. But at a later point in time if he wishes to make a statement, we would be pleased to insert it.

TESTIMONY OF HON. NORMAN Y. MINETA, A U.S. REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. MINETA. Mr. Chairman, if I might go ahead and submit my full statement for the record, I would appreciate it.

Mr. KASTENMEIER. Without objection.

[The complete statement follows:]

PREPARED STATEMENT OF NORMAN Y. MINETA

Mr. Chairman and the distinguished Members of the Subcommittee, I would like to thank you for allowing me to present my views on H.R. 1028, the Semiconductor Chip Protection Act of 1983, which Representative Don Edwards and I also introduced in the last two Congresses. H.R. 1028 would amend the Copyright law to provide ten-year protection for the mask work of a computer chip. Passage of this legislation is vitally important to the continued strength and viability of our electronics industry.

Integrated circuits or semiconductor chips contain hundreds of thousands of transistors, the basic building blocks of chips, photographically etched onto a silicon wafer. Each chip is typically a quarter-inch square. It is extremely important that the transistors fit on to the chip in the most efficient and economic manner possible. Designing the best layout or mask for these transistors is a time consuming and costly process, Often a company will spend millions of dollars to develop the mask work for a particular chip. It is this design or mask which the bill before us today seeks to protect.

Copyright protection is necessary because although it may take years and millions of dollars to develop a particular mask design, a foreign or domestic pirate company can copy this design in a short time, and at virtually no cost, through the process of microphotography. The pirate company can then flood the market with cheap copies of the chip because it does not have the development costs of the original company. If this type of mask theft is allowed to continue, companies will have no incentive to develop new mask designs and the quality of our electronics industry will fall. The United States lead in this vital industry will diminish.

Copyright protection for the mask is an expansion of the use of the Copyright law. However, it is not an illogical expansion and it is clearly the best possible solution to this immediate and serious problem.

Patent protection for the mask, a solution that has been suggested, is not possible. The Patent Act makes patents available for plants, ornamental designs, or novel items of utility. The mask design does not fall under any of these categories. It is not a plant. It is clearly not just ornamental. And the layout of transistors on a chip does not meet the standard of a unique invention.

However, the mask work can logically be defined as a "writing" under the Copyright Act. Examples of "works" similar to the mask design to which copyright protection has been extended include maps, blueprints, and film images, A mask work is similar to a motion picture in that it is a series of related images. In the case of a mask work, these are the images or masks that embody the pattern of the various layers of a semiconductor chip.

It is argued that the Copyright law does not cover items of utility and therefore the mask work should not be given copyright protection. However, the Copyright law has often been extended to many items of utility including belt buckles, telephone books, ashtrays, doorknockers, and advertisements.

When the Copyright Act was first enacted no one could even envision such a product as the mask work or a computer chip. Our laws must be adapted to fit the realities of our times. The extensions of Copyright protection to the mask work may be somewhat unique, but it does not conflict philosophically with the purpose of the Copyright law, which is to protect the author of a work while providing wide dissemination and use of the product.

Furthermore, the bill recognizes the unique properties of the mask work. First of all, the bill recognizes the commercial realities of the computer market by providing for only a ten-year copyright for the mask work.

Secondly, the bill contains a compulsory licensing provision that requires the owner of a copyright of a mask work to grant a compulsory license to any applicant who innocently purchases and illegally copied chip. This provision protects the innocent company who spends millions of dollars developing a computer around an illegally copied chip. Compulsory licensing is a just market solution to this potential problem.

In summary, I would just like to stress once again the importance of this legislation to the electronics industry, Copyright protection for the mask design is necessary immediately to prevent erosion of our leadership in this expanding and highly competitive industry.

It has been a pleasure sharing my views with you.

Thank you.

Mr. MINETA. Mr. Chairman, distinguished members of the subcommittee, I would like to thank you for allowing us to present our views on H.R. 1028. The Semiconductor Chip Protection Act of 1983, which Congressman Edwards and I have introduced, is similar to the bill we have introduced in the last two Congresses.

Passage of this legislation is vitally important to the continued strength and viability of our electronics industry and, more importantly, is needed to keep this country in the leading edge of the high-technology industry.

Copyright protection for the mask work of computer design is necessary to keep pirates from flooding the market with cheap copies of a chip developed by another company at considerable cost and time. If this type of mask theft is allowed to continue, companies will have no incentive to develop new mask designs and the quality of our electronics industry will fall.

A copyright protection for the mask is an expansion of the use of the copyright law. However, it is not an illogical expansion, and it is clearly the best possible solution to this immediate and serious problem.

The mask work can be logically defined as a writing under the Copyright Act. Examples of works similar to the mask design to which copyright protection has been extended include maps, blueprints, and film images. The mask work is similar to a motion picture in that it is a series of related images. In the case of the mask work, these are the images or masks that embody the pattern of various layers of a semiconductor chip.

It is argued that the copyright law does not cover items of utility; therefore, the mask work should not be given copyright protection. However, the copyright law has been extended to many items of utility, including belt buckles, telephone books, ashtrays, door-knockers, and advertisements.

Our laws must be adapted to fit the realities of our times. The extension of copyright protection to the mask work may be somewhat unique, but it does not conflict philosophically with the purpose of the copyright law which is to protect the author of a work while providing wide dissemination and use of the product.

In summary, I would just like to stress once again the importance of this legislation to the electronics industry. Copyright protection for the mask design is necessary immediately to prevent erosion of our leadership in this expanding and highly competitive industry. Thank you very much, Mr. Chairman.

Mr. KASTENMEIER. We thank our colleagues for their presentation. May I ask what has happened during the past 4 years to the opposition. But as you know, among domestic corporations, and certain industries, there was opposition developed in 1979. How does it come about that these same companies today do not seem to have any reservations as far as we know?

Mr. EDWARDS. Mr. Chairman, I do not know what went on in the various companies, and I believe that there were two or three of them opposed back in 1979. But since 1979 these companies—and I know the names of them—have come to realize that there is a serious piracy problem. And a lot of the piracy comes from overseas from a country or two with which we have copyright treaties. And so they have made a complete turnaround and now, to the best of my knowledge, unanimously support the legislation. And these are big companies that were in opposition in 1979.

Mr. MINETA. Mr. Chairman, I might add that the innocent purchaser this time is protected so that as compared to the last time when there was what we thought was united support for the legislation, as you will recall at that hearing, we had testimony from the industry association and everyone was suprised at a company at that point that expressed opposition to the bill.

But since then, that opposition has disappeared. And I think it may be because of the protection that this legislation affords the innocent purchaser of pirated chips.

Mr. KASTENMEIER. You say there is language in the bill which goes to that point that was missing from the original bill presented in 1979? Is that an infringement?

Mr. EDWARDS. The current bill differs from the current legislation in three respects: it does include a provision for giving innocent infringement, it does provide for compulsory and reasonable licensing of pirated designs, and it provides for a shorter term of copyright of 10 rather than 75 years.

Mr. KASTENMEIER. There is no question that I think this would be useful legislation to the creators of these new designs and, chips. Maybe industry is best capable to answer this, but let me ask you anyway. Might this legislation come too late? Are we locking the barn door after the horse has been stolen, so to speak, in the technology of this area?

Mr. MINETA. I do not believe so, Mr. Chairman. There are two parts to this. One, we have to bring current laws into the reality of the times. And I think at the same time that that serves as the foundation for what comes in the future as far as any technological advance. If there is any one area that the United States leads and our companies lead, it is in innovation.

It seems to me that it is something we have got to protect which is our asset, it is our ability to be innovative. Others may copy it, but it just seems to me that what is paramount to the interests of this country is to protect those who are innovative and who are really creating jobs for our own industries here as well as, more importantly, creating those in an export sense. And to me this legislation becomes vital in that respect.

Mr. KASTENMEIER. One other question that obviously impacts very heavily on this legislation is a recent judicial decision which is at odds with the Copyright Office. It is the decision rendered by Federal District Judge Hubert Will from Illinois that says that information stored on a silicon chip is in fact copyrightable. And he cites a case, *Strohon* v. *Midway*. I do not know if you are familiar with that decision, but if you are, does the ruling help or hinder your bill?

Mr. EDWARDS. Mr. Chairman, I know about that decision from Illinois. And there have been conflicting decisions on this issue: that is *Apple* v. *Franklin,* which holds the opposite. So there are court decisions which hold one way or the other. And the real problem, of course, is that the Copyright Office has not and will not accept semiconductor chip layouts for registration under their interpretation of the copyright law.

Mr. KASTENMEIER. So in that respect, while you endorse the principle embodied in your bill, it is not that helpful from the standpoint of resolving the issue?

Mr. EDWARDS. That is correct. The Will decision is not.

Mr. KASTENMEIER. A witness who will testify later says that his view is that the bill is not properly drafted, that the concept of chip protection should be proposed as a severable unitary measure, not as a piecemeal attachment to the Copyright Act. I wonder if you have any reaction to that argument?

Mr. MINETA. Well, let me—again, Mr. Chairman, I am not a lawyer; my background is as an insurance broker, so I am not really sure how this relates to this bill. But if we are going to wait for a perfect bill to take care of everything that has to be dealt with in the copyright laws, none of us are going to be around. And in fact, the industry may not be around.

It just seems to me that even though it may be a piecemeal approach, we better darn well protect what we have now and not wait until someone comes along with a comprehensive complete bill dealing with all of the idiosyncracies and wants and desires and pressures that exist on this committee.

Mr. KASTENMEIER. I suppose another answer would be that if the witness can convince the committee that in some respect H.R. 1028 ought to be redrafted, that it can be drafted if it will be effective, if a convincing argument can be made.

But I certainly understand your answer and appreciate it.

I am going to yield at this point to my colleague, the gentleman from Ohio, Mr. Kindness.

Mr. KINDNESS. Thank you, Mr. Chairman.

And I thank our colleagues for their presence and testimony this morning. The first thing I would like to explain is that I am the new kid on the block in this area with copyright law and would appreciate your tolerance.

There is a conceptual question that I have and I would like to pursue with you. I am having difficulty in differentiating the protection that ought to be accorded to the mask work that goes into the production of a chip, microprocessor, let's say, as distinguished from the content that can be produced by the use of that microprocessor.

The point was raised, and what we raised in testimony from the publishers was that there would be incorporated into the functioning of the microprocessor presumably in the future and even now the content of a publication, a book. Perhaps whole libraries would be stored in this manner in the future. But the original work which would be subject to copyright protection, if in printed form, when incorporated into a microprocessor then becomes at conflict with the protection of that product, and is in conflict with the protection of the microprocessor itself or the mask work in it, or could potentially be.

I say this because it is my understanding of the industry that it would not be very practical for a publisher, let's say, to have his own microprocessor production and thus keep the control of the whole work that is involved, the book.

Do you see the possibility that this legislation ought to have in it some provision that separates out the protection of the copyright law that ought to be afforded to the mask work on the one hand and then find some way of making it compatible with the copyright protection that logically should be afforded to that book or that work when it is converted into microprocessor form on the other hand?

Would it be reasonable, in your view, as authors and sponsors of the bill, if it is possible to do so, to afford that separate status and protection under the copyright laws for those two products?

Mr. EDWARDS. Well, Mr. Kindness, we might be talking about apples and oranges.

Mr. KINDNESS. Would you care to change the apple part?

Mr. EDWARDS. Because the subject of books and libraries is something that your subcommittee has long dealt with, authors and artists have received appropriate protection, largely through the legislation enacted that began in the subcommittee that you are a member of. And I do think that it is a little bit of a different subject, although I would not have any objection to the concept that you suggest.

Mr. KINDNESS. Well, once the book is embodied in a microprocessor, well, then—as I say, I am having a conceptual problem here—they become almost one and the same. I have a book that I have published and printed, and I go to you as a producer of microprocessors, and I say, I want this converted into circuitry so that it can be used electronically and conveyed in that manner.

Our contractual relationship can probably handle most of the property rights area up until we sell that microprocessor on the marketplace and somebody else takes it and reverse engineers it. And then they have got my book.

This is the part I am getting a little bit concerned about as we go through this. Should we be addressing that problem, or do you feel that is something that we ought to be leaving out of this question at the present time?

Mr. EDWARDS. I believe it is very possible that a book is already protected by the copyright law. Certainly insofar as the copying of books and resale and the use in libraries. And programs are already protected under the copyright laws, but layouts themselves are not. This is the layout that would be protected, not the final product. That would already be protected.

Mr. MINETA. Also, Mr. Kindness, I think that Mr. Dunlap, who will be testifying later on, who is representing the semiconductor industry and is also corporate counsel for one of our leading companies, will probably be able to address that issue.

Mr. KINDNESS. But if I might just put the basic question then. If there appears to be a reasonable and amenable way to deal with that, assuming that what I am describing is a problem which I believe it is, there is no basic objection on the part of the authors relative to addressing that question in this legislation.

Mr. EDWARDS. I believe that the Senate addresses that. I believe the bill says that copyright in a chip does not add to or lessen any other type of copyright relating to a work embodied in a chip. So that perhaps might answer that. And I'm sure that your expert examination of this issue can resolve that, but I do appreciate your point.

Mr. KINDNESS. Thank you.

Mr. KASTENMEIER. May I ask my colleagues—we have a vote on. We have about 10 minutes. Would you—and I'm addressing myself to Mrs. Schroeder, and Mr. Synar—care to ask questions now or come back after the vote.

Mrs. SCHROEDER. I think they've convinced us. I'm prepared.

Mr. KASTENMEIER. Well, do you have questions?

Mr. SYNAR. No questions.

Mr. KASTENMEIER. Would our witnesses care to return following the vote?

Mr. FRANK. Since Mr. Mineta said he wasn't a lawyer, I'm sure I don't have any problems with him.

Mr. KASTENMEIER. Well, if my colleagues have no questions of the witnesses, then on behalf of all of us, I would thank you very much for your presentation this morning, and we appreciate your contribution.

The committee will recess for 10 minutes and return.

Mr. EDWARDS. Thank you very much.

[Recess.]

Mr. KASTENMEIER. The committee will come to order. I'd like to welcome our first public witness, Jon Baumgarten. Mr. Baumgarten is well known as an expert on copyright law and was General Counsel to the Copyright Office from 1976 to 1979. He has reported to this committee before. He is now an attorney in private practice with the law firm of Paskus, Gordon & Hyman, and represents the Association of American Publishers. Welcome, Mr. Baumgarten.

TESTIMONY OF JON A. BAUMGARTEN, COPYRIGHT COUNSEL, ASSOCIATION OF AMERICAN PUBLISHERS, INC.

Mr. BAUMGARTEN. Thank you, Mr. Chairman. May I ask at this point that my prepared statement be entered into the record, and I'll essentially summarize it as we proceed.

[Complete statement follows:]

PREPARED STATEMENT OF JON A. BAUMGARTEN, COPYRIGHT COUNSEL, ASSOCIATION OF AMERICAN PUBLISHERS, INC.

Mr. Chairman and members of the Subcommittee, I am Jon A. Baumgarten, a member of Paskus, Gordon & Hyman, copyright counsel to the Association of American Publishers, Inc. ("AAP"). The AAP is a trade association representing America's "book and journal" publishers. The phrase "book and journal" appears in quotation marks because, if limited to its conventional paper-and-binding connotation, it does not adequately describe our members' activities. This is particularly the case with respect to the proposed legislation before you this morning. Our members do publish books—fiction and non-fiction trade books, textbooks at all educational levels and related materials, reference works and encyclopedias, self-help and do-it-yourself books and others—and scientific, technical, medical, scholarly, and professional journals. But they also, and increasingly so, are intimately involved in the creation and publication of new media: computer programs and software of general consumer, business, and other special-market nature; computer-assisted learning materials (including educational and like games and audiovisual works) and "courseware"; and automated data bases. As will be shown below, the provisions of H.R. 1028 may substantially impact upon the interests of every segment of our membership, and we greatly appreciate the opportunity to appear before you.

Before turning to a more particular description of our interests and views regarding H.R. 1028, I want to make clear at the outset that the AAP is not questioning the creativity, skill, labor, or investment of chip designers, or their need for and entitlement to appropriate protection from piracy.

Nor do we challenge the twin premises of Congressmen Edwards and Mineta in introducing this legislation—namely, that the proprietary interests of creative entrepreneurs must remain properly safeguarded from technological onslaught, and that innovative legislation may be the appropriate vehicle toward this end. Quite the contrary—the copyright interests of book and journal publishers have particularly suffered from indiscriminate application of the new technologies of disseminating and reproducing intellectual products, and we can well understand the concerns of other industries with similar threats. What we do question is the precise nature of the bill currently under consideration, and it is to this that I will now turn.

AAP's interests and concerns with respect to H.R. 1028 are essentially twofold:

A. AAP urges that the Committee approach chip protection as a severable, unitary measure and not as piecemeal amendments to the basic Copyright Act.

In making this recommendation, AAP supports what has been called the "sui generis" approach to chip protection. We have avoided this description both because it has broader connotations,[1] and in the event it offends those who assert that some copyright concepts—particularly automatic protection based upon independent creation or "originality" rather than patent prosecutions under standards of "novelty"—can and should be applied to these products. Our difference is not with this assertion; if the case can be made for the application of selected copyright concepts, Congress might consider doing so. Our concern lies with the obverse—that is, with the fundamental departures from the copyright system that accompany the proposal, e.g., the extension of Copyright Act protection to utilitarian objects that, it is acknowledged, may not be "writings" under the Constitution (and, for example, the potential impact of this on the evidentiary advantages of copyright registration); the

[1] It is sometimes urged that "sui generis" protection be accorded, in lieu of copyright as such, to software. The AAP does not agree with this contention, and considers it distinguishable from the issue of chip protection. The Copyright Act generally appears to be operating acceptably for software protection and no basic departures from copyright precepts yet appear necessary. Indeed, part of our concern with H.R. 1028 is that it may inadvertently weaken software protection. See ¶B., below.

according of an apparent "use" right; the limitations on remedies against infringers and the extension of compulsory licensing; and, most notably, the limitation imposed on the duration of protection of this particular class, and the distortion of the fair use doctrine to accommodate reverse engineering.[2]

It must be emphasized that our concern is not born out of a mere desire for ideologically "pure" copyright law, nor—as noted above—aversion to innovative legislation. It lies, instead, with the blurring or distortion of principles and the establishment of precedents that may have untoward and unintended consequences for copyright protection of our works, and those of other copyright proprietors.

In sum AAP believes that H.R. 1028 would effect such basic modifications in copyright law that a unified approach to chip protection, identified as separate from the general Copyright Act itself, is called for.[3] We submit that the price to be paid in additional draftsmanship will be well worth the resulting greater cogency and precision.

B. AAP urges that (1) the limitations on chip protection be expressly made inapplicable to other works fixed, represented, or embodied therein; and (2) that the copyright owners of such works be assured of protection from unauthorized reproduction in chips.

From the viewpoint of our industry, semiconductor chips and their associated products are essentially vehicles for the dissemination and efficient use of our works. Clearly, our software programs, data bases, and audiovisual works (as represented, for example, in instructional "games") will be—and in some cases already are—marketed in "chip form" for use in connection with business, home and school computers and micro-processor based devices. And it would be mistaken and shortsighted to assume that this will not be the case with respect to the content of our books and journals. Thus, Townsend Hoopes, President of the Association, has described the forthcoming world of "books-on-a-chip" as follows:[4]

"Some computer scientists believe that computer technology, particularly the microcomputer, which today can compress information by ten thousandfold, will give us entire books printed on a single silicon chip by the late 1980s. Later it may be possible to store a whole library in about the same space now occupied by a paperback novel. According to this theory, books will be produced on silicon chips and mailed by the dozen in small envelopes direct to the reader. The reader will insert the chip into a reader terminal, which may for aesthetic reasons resemble a traditional book, with leather covers and gold clasps. The terminal will translate the binary code into English, with adjustable print size, and the reader will take it from there."

Others have made similar forecasts. [5]There is no reason to believe that these hypotheses are too remote for contemporary Congressional consideration—a conclusion strengthened by recent developments in connection with increased capacity memory devices. [6]As Dr. Elie Shneour, in an essay entitled "A Look Into the Book of the Future" (*Publishers Weekly,* January 21, 1983 at 48), recently stated:

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[2] The discussion of "fair use" and "reverse engineering" at p. H645 of the Congressional Record of February 24, 1983 is not entirely clear. For example, the fact that otherwise infringing activity may involve "teaching, analysis, or study," whether in an educational or business environment, cannot itself lead to a conclusion of fair use. *E.g., Wihtol* v. *Crow,* 309 F. 2d 777 (8th Cir. 1962); cf. Cong. Rec., May 4, 1983 at S. 5992, (referring to pirates "study[ing] the design"). And the House memorandum (p. H645) itself blurs the distinction between "fair use" and the mere adoption of ideas (see e.g., 3 Nimmer, Copyright § 13.05 at 13-55), and reverse engineering. Additionally, it has been questioned whether the kind of "reverse engineering" intended to be privileged by the bill can fall within the general doctrine of fair use without distorting its role and contours. See, e.g., Copyright Protection for Imprinted Design Patterns on Semiconductor Chips, Hearings Before the Subcommittee on Court, Civil Liberties and the Administration of Justice of the House Committee on the Judiciary, 96th Cong., 1st Sess., April 16, 1979 at 21, 54, 61.

[3] We note that a similar approach is taken in the recent introduction in the House of Representatives of H.R. 2985 on May 11, 1983. This measure, providing for the protection of designs, is a particularly applicable precedent. And we do not think the proponents of chip protection need become hostage or subject to the fortunes of that bill. There is no reason why protection for designs cannot start with (or even be limited to) chips. The principle of unified, separately identifiable legislation is the important point.

[4] Remarks of Townsend Hoopes, president, AAP, before the NYU Workshop on Book Publishing: "The Electronic Revolution and the Future of the Book," Jan. 22, 1982.

[5] E.g., evans, "The Micro Millenium" 115–117 (1979); U.S. News & World Report, May 9, 1983 at A-8.

[6] See, e.g., Washington Post, May 18, 1983 at A-1.

"The sociologist Wilbur Schramm has recently pointed out that it took not less than 5 million years for evolving humankind to go from the primitive elements of a spoken language to the written work. From the written word of the tablets and scrolls to movable-type printing required another 5,000 years. From Gutenberg's Bible to television, less than 500 years proved necessary. It has been less than 50 years since the first electronic computer was devised. Each major advance in information handling has taken one order of magnitude less time than the preceding one. On that basis, may we expect the book of the future to be evolving before the end of this decade?"

(1) We understand that both the protection accorded under H.R. 1028 and the limitations thereon—for example, the "compulsory license" of proposed § 119; the limited term of protection under proposed 302(f); and the provision for "innocent infringers" in proposed § 501(e)—are directed toward the creation and unauthorized use of chip architecture, topography, configuration or the like, but not toward software, data bases, or other literary or audiovisual works that may be fixed, represented, or embodied therein. We believe that it is imperative that this principle be expressed in any chip legislation moving forward from this hearing. Cf., e.g., 17 U.S.C. 114(c) (limitation of rights in sound recordings "does not limit or impair" the right to control public performance of music in the same phonorecord). We would be pleased to work with committee staff in developing appropriate language. In the absence of such an express reservation, particularly in light of the complex issues that will be brought before the courts under any chip legislation enacted, we fear that the Congress may, erroneously, be found to have limited the rights of publishers and those of authors in their creative endeavors by happenstance of the vehicle chosen for dissemination. Indeed, even the risk of such a result could dampen the ability or willingness of our industry to use or license chip distribution—a result that would be far from the interests of the bill's sponsors, proponents, and the public.

(2) A related consideration applies to the limited application of the term "copy" adopted in Sec. 2 of the bill (p. 3, lines 3-6). If at some point one or more of our members' copyrighted computer programs or literary works were embodied, without permission, in a chip device, we are concerned that this provision could—inadvertently, we believe—impair the copyright owner's ability to proceed against this unauthorized use as a violation of the exclusive rights under 17 U.S.C. 106 to "reproduce the copyrighted work in copies. . ." and to "distribute copies of the copyrighted work. . . ." This is because the reference to "cop[ies]" in Sec. 2 of the bill does not expressly include that term as used in 17 U.S.C. 101 (definitions) or 106.[7]

Thank you for the opportunity to present these views.

Mr. BAUMGARTEN. Mr. Chairman, members of the subcommittee. My name is Jon Baumgarten. I am a member of the firm of Paskus, Gorden & Hyman, copyright counsel to the Association of American Publishers. The AAP represents publishers of books of all types and also, increasingly so, publishers of new media, including software and computer-assisted learning materials.

We believe that the provisions of H.R. 1028 will substantially impact on the interests of every segment of our membership and we greatly appreciate the opportunity to make these views known to you this morning.

Before turning to a more particular description of our interests and views regarding H.R. 1028, I want to emphasize at the outset that the AAP in no way questions the creativity, skill, labor, or investment of chip designers or their need for protection from piracy and entitlement to protection.

And we do not challenge the premises of Congressman Edwards and Congressman Mineta in introducing this legislation; namely, that the proprietary interests of creative entrepreneurs must remain properly safeguarded from technological onslaught, and

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[7] Because the final clause of the pertinent provision of Section 2 (page 3, lines 5-6: "this is subject to the exclusive rights described in section 106") itself may encompass less than all semiconductor chip products in which AAP members' works are reproduced, it does not appear that this issue can be resolved simply by adding sections 101 and/or 106 to the enumeration now in Section 2 of the bill.

that innovative legislation may be the appropriate vehicle toward this end. Indeed, quite to the contrary, it is our industry, the book and journal publishers, who have long suffered from indiscriminate application of the new technologies of disseminating and reproducing intellectual works. We can well understand and sympathize with the concerns of other industries, such as the chip design industry, with similar threats. What we do question is the precise nature of the bill currently under consideration. And it is to this that I will now turn.

AAP's interests and concerns with respect to H.R. 1028 are essentially twofold. First, as the chairman alluded to earlier, we urge that the committee approach chip protection as a severable, unitary measure—what some call the sui generis approach. In saying this I do not want to confuse the record. We do not oppose those who assert that some copyright concepts, particularly automatic protection based upon independent creation rather than patent protection based upon long, time-consuming prosecution, can and should be applied to chip design. If the case can be made for that form of protection, Congress may well consider doing so.

Our concern lies with the obverse; that is, with the fundamental departures from the copyright system that appear in this bill. This includes a number of provisions, such as the extension of the copyright protection to utilitarian objects, to objects that the bill itself acknowledges may not be writings, the according of an apparent use right to control any use of the work, limitation on remedies against innocent infringers, the extension of compulsory licensing, and, most notably, the limitation imposed on the term of protection of this particular class of works, and equally importantly, if not more so, the apparent distortion of the fair use doctrine of conventional copyright to accommodate reverse engineering.

I would like to emphasize that our concern is not borne out of a desire for ideologically pure copyright law, and certainly, as noted above, it is not generated by any aversion to innovative legislation. Our concerns do lie with the blurring or distortion of principles and the establishment of precedents that may have untoward and unintended consequences for copyright protection of our works, both conventional books and journals and software and its related products, and those of other copyright proprietors.

Mr. Chairman, members of the subcommittee, that leads directly to our second point of concern. The Association of American Publishers also urges that, as a matter of legislation in any form, the limitations on chip protection—limited duration, compulsory licensing, innocent infringement and the like—must be expressly made inapplicable to other works fixed, represented, or embodied in chips. As a related point, the copyright owners of such other works must be assured of protection from the unauthorized reproduction of our works in chips.

From the viewpoint of our industry, semiconductor chips and their associated products are essentially vehicles for the dissemination and efficient use of our works. Our software programs, our data bases, and our audiovisual works will be, and in some cases already are, marketed in chip form and, clearly, for the reasons given on page 5 of my statement, this will also be the case in the near future with respect to our books.

Progressing from this assumption, we have two specific concerns. It is our understanding that the protection accorded under H.R. 1028, and more importantly, the limits on that protection, are directed toward the design or architecture of the chip itself. We believe it is imperative that this be made clear in the language of any chip legislation moving forward from this hearing.

We want to insure that these limitations are not inadvertently attached by an unsophisticated court or otherwise to our books, journals, software, or other works when they are marketed in chip form.

This is the point Mr. Kindness alluded to earlier, and as Mr. Edwards noted, this objection was taken under serious consideration in the other Chamber and attempts are being made to resolve it.

A related point applies to a more technical portion of the bill, in which the word "copy" is defined to include only certain sections of the Copyright Act. Our concern is that someday in the future some company may incorporate one of our books or journals or some of our software or audiovisual works, in chips without our permission. Under the Copyright Act, our rights to control reproduction and distribution of our works under section 106 may be limited to reproduction and distribution in copies, yet section 106 is not one of the sections whose use of the word "copy" is incorporated in the new bill. We are therefore concerned that, inadvertently, we may be deprived of protection from unauthorized reproduction in chip form.

Mr. Chairman, members of the subcommittee, I thank you for the opportunity to present our views, and I would be pleased to answer any questions that you may have.

Mr. KASTENMEIER. Thank you very much, Mr. Baumgarten. Before I yield to the gentleman from Massachusetts, let me ask you one thing, to just be clear. You have some general observations with respect to legislation, and you have some special ones under B, in which you want to insure that the traditional works of publishers, authors and others are protected, no matter what sort of legislation is adopted.

Is it your position that further legislation is necessary for their purposes, even though nothing might be done and H.R. 1028 might not be acted upon? You suggest earlier that authors and publishers have suffered as a result of advance of technology. Are you suggesting that changes in law are clearly necessary to protect the right of your clients as publishers, owners, proprietary rights?

Mr. BAUMGARTEN. At this time, Mr. Chairman, we do not have any specific legislative recommendations. We are trying to work things out, either in the course of discussions or—if necessary—litigation with, for example, the university community, the library community, and photocopying establishments. At this point, we do not have a specific legislative menu to attack these problems.

Mr. KASTENMEIER. I'd like to yield.

Mr. FRANK. Is it your position that some protection is warranted, or there should be copyright tailored to this particular area?

Mr. BAUMGARTEN. I think it's slightly different, Mr. Frank. From our standpoint, we think that protection may be warranted. We also have no objection to a type of protection that looks like copyright in part. For example, instead of having to prosecute a patent application over a number of years with extraordinary fees, we can understand the chip industry's desire to rely on the copyright principle of automatic protection without mandatory registration. We have no objection to picking up selected copyright aspects. Our problem is that other copyright aspects have been changed to meet the particular problems of this industry, and we are concerned that there are so many of them in this bill as drafted, that the impact upon our works can be harmful.

Mr. FRANK. What specific?

Mr. BAUMGARTEN. I think the two that I've just mentioned are the limiting of the term of copyright to 10 years, for a particular class of works incorporated into the copyright law, and——

Mr. FRANK. Your point is, the way this is drafted, the text would lose its copyright protection?

Mr. BAUMGARTEN. That's really what Mr. Kastenmeier referred to as point B and that is one objection. We are concerned that one day somebody will claim: "If you copy a chip you can copy the book embodied in the chip since it's more than 10 years . . ." But that particular issue can be taken care of.

Mr. FRANK. But that's really explicit. One doesn't apply to the other.

Mr. BAUMGARTEN. The second aspect of this is a bit more philosophical, but I don't think any less real. Quite frankly, we are concerned about the idea of particular works being singled out in the organic copyright law for limited duration and the precedent that may serve for arguments being made with respect to other works.

Mr. FRANK. You say particular work; you mean——

Mr. BAUMGARTEN. Class of works.

Mr. FRANK. You think that somebody might use the fact that the chip law is 10 years, and might use—might argue that other copyright should be over?

Mr. BAUMGARTEN. Correct. For example, that a scientific encyclopedia should only be protected for 10 years, and then be dedicated to the public. That is an argument that we totally object to, but I don't think you want us to go into that further at this time. However, we are concerned.

Mr. FRANK. You see, I'm not. That's a pretty broad gap for anybody to have to argue.

Mr. BAUMGARTEN. Yes, sir.

Mr. FRANK. I think it can be dealt with. I know that people worry about precedents. That one would seem to be overly difficult. Are there other problems?

Mr. BAUMGARTEN. There is one that has not come up yet in this hearing, because of the order of the witnesses, but did arise in the Senate hearing and particularly troubles us. As the chairman will recall, I have been involved with this particular aspect since 1979. It's this notion of reverse engineering. We understand that the chip industry does not want to inhibit reverse engineering. We have no quarrel with that as such. Our problem is that some of the definitions of reverse engineering that we have heard are so broad that to consider them fair use, as this bill apparently would do, would, in our judgment, distort the doctrine of fair use for all purposes. We would much rather see a specific definition of reverse engineering, rather than encumbering the doctrine of fair use which, in our judgment, does not fit the facts of reverse engineering.

Mr. FRANK. In general, it sounds to me like your objections are not so much for specific proposals which are made in regard to chips, but you fear that they will be either a precedent or an analog or something else, and that if we were to make very clear that that wouldn't happen then that would resolve your problem.

Mr. BAUMGARTEN. That would go a long way toward doing so. But I do think that some of these issues are attributable to a lack of separate, specific treatment for chips such as in the nature of the design legislation which was recently introduced.

Mr. FRANK. If you were to deal with it that way, not specifically—you don't feel that the specifics of the chip protection would be inhibited?

Mr. BAUMGARTEN. No, sir.

Mr. FRANK. Only that it would——

Mr. BAUMGARTEN. No; some of this could be taken care of in legislative language. Some of it could be taken care of with report language, but we have no objection to the bill as it directed toward protection of chips.

Mr. FRANK. Thank you. I have no further questions.

Mr. KASTENMEIER. The gentleman from Ohio.

Mr. KINDNESS. Thank you, Mr. Chairman. Mr. Baumgarten, I was perhaps premature in my earlier questioning. I should have waited until the time when you were at the witness table, but I did want to get the impression of the authors of the bills as to whether there was any problem, any sort of problem that they foresaw dealing with this matter, described at that time.

In H.R. 1028, it's my understanding that over on the Senate side, the effort there has been to, in effect, say that the body of the book or other such work in a microprocessor will have no effect upon its other copyright protection. And I—it has been said that the publishing industry is satisfied that that language would take care of the problems that you perceive with regard to that one aspect of the matter; is that correct?

Mr. BAUMGARTEN. Yes, sir, may I make one additional comment? In part B of our statement, we refer to two problems of that nature: one being the lack of an express provision that the limits on chip protection have no impact on works in the chip; and the second, a very technical question, the limited application of the word "copy." The amendment that you mentioned, would solve the first problem. The second problem could be solved, and we would be pleased to work with Senate staff and, hopefully, the staff of this committee to a similar accommodation.

Mr. KINDNESS. What I don't understand then is here's a book, say [indicating] and here's the result of the microprocessor he was working on [indicating], but this may be under copyright protection, but this is not [indicating]. Does that not concern the publishing industry?

Mr. BAUMGARTEN. Not at this point, sir, because we feel confident that we could protect authors by proceeding against infringement of the book. If someone were making an unauthorized chip copy, and therefore, duplicated the book or sofware in it, with the exception of one case, the law has developed favorably. It might simplify matters, sir, if you will forget about chips for a moment and consider any one of these cassettes or a phonograph record. That object conventionally has two works in it. One is called the musical work and one is called the sound recording, which is a particular interpretative rendition of the music. For many years the music in the phonorecord or cassette was protected, but the sound recording was not. Now both are protected, but in different manners. And the statute clearly provides that the limitations on the protection of the sound recording do not impact upon the protection of the music. It's essentially the same thing we are asking for in this bill—that is, that the 10-year term for the chip, or the compulsory license for the chip, or the special provisions for innocent infringers of the chip, be made expressly in applicable to other works fixed in the chip. If someone copies a chip and only a chip, they can take advantage of those provisions. But if they do it so they can reproduce our book or software, we don't want to be limited to a 10-year term or subject to compulsory licensing or claims of innocent infringement, just because we have now licensed somebody to distribute our work in chip form rather than paper and binding.

Mr. KINDNESS. Well, OK, let's take the chip that's on the market and someone buys it, and through reverse engineering, produces a different chip, but what its functions will perform is the reproduction of that book. Are you saying that you believe that the chip protection that we're talking about in 1028 would extend to the book?

Mr. BAUMGARTEN. No, sir, we believe our conventional book protection will remain with the book even if reproduced from or in chip form.

Mr. KINDNESS. This is a different form. What would that do?

Mr. BAUMGARTEN. OK. The fact that the book is now represented in electromagnetical impulses, on-and-off switches, rather than printed text, would not, in our judgment, detract from the protection of the book, any more than it would when one goes from handwriting to manuscript to final printed text.

I admit that the *Apple* v. *Franklin* case, which was referred to earlier may throw some cloud on that conclusion but I do not think when that case is finally decided, it will hurt us. I think that, if affirmed, it will be limited to its facts, and more likely, I think it will be reversed. We are fairly confident that protection for our books and our computer programs will remain with those works whether represented in the conventional visually preceivable form or in some electromagnetic form. We are not asking for additional protection for our books and software at this point. We simply want to make sure that the limits on protection of the chip do not limit the protection of the book or software in whatever form it is distributed.

Mr. KINDNESS. So you're not concerned about reverse engineering of the chip, leaving that unprotected?

Mr. BAUMGARTEN. If somebody reverse engineers the chip and reproduces our book as included in the chip, and if that falls outside the fair use principle—which in many cases it would—I think we would generally be satisfied with the protection we already have to proceed against them for making unauthorized copies or adaptations of our works. However, my reference to the word "copy" does raise an additional technical point, because this bill says the word "copy" applies to chips only for the purpose of certain sections of the law and these do not include our basic right to reproduce. As soon as we solve this "copy" problem, we'll be fairly confident that we'll be able to handle the issue.

Mr. KINDNESS. Thank you.

Mr. KASTENMEIER. I have a technological question or technical question. Am I to understand that these chips have a capacity—storage informational bits—which may or may not be the same? If you produce a given chip, whether it has 256 K capacity or something else, then you can introduce into that chip different pieces of information than you would another chip made precisely the same way, so that it becomes a more or less storage factor that intrinsically is not the book, but merely the device for accepting, retaining, and for discharging bits of information. Therefore, it's not an analog, as you suggest, you cannot say that these are the same, that one is the chip and one is the published work. They are totally different in that regard; is that the case?

Mr. BAUMGARTEN. Once you make the vehicle——

Mr. KASTENMEIER. We're talking about the vehicle. We haven't talked about a vehicle, because almost anything can be stored in here.

Mr. BAUMGARTEN. From our viewpoint, we do view the chip as a vehicle. That's the way we see it. Something that will carry our books and software. The chip industry doesn't see it as only a vehicle; they see it as a work in and of itself. But I think that in concept, notwithstanding this difference of viewpoint between the publishers, the chip industry and the members of this committee, no one intends to limit the protection now available to books and programs because of the limits of protection on the chips. And I think we have to make that clear in the legislation.

Mr. KASTENMEIER. I don't quarrel with that, but I want to know the theory we're talking about in comparative terms; that one is not the other. The chip may, indeed, contain proprietary works, may contain book A, but that chip or some other chip may contain totally different bits of information, even though their capacity may be the same or made by the same manufacturer.

Mr. BAUMGARTEN. I would agree with that description. It is a vehicle.

Mr. KASTENMEIER. It's like a library with shelves on it. So it's not necessary to compare the library to the book, but merely the library may contain a book or may not contain a book; and, of course, the question of whether librarians or chips will disseminate these books in an unauthorized way is another matter. I'll yield to Mr. Sawyer.

Mr. SAWYER. I haven't got a good enough grasp of this to ask any questions. To tell you the truth, I'm more interested in listening, until I think I understand it better than I do now.

Mr. KASTENMEIER. The gentleman from Illinois, Mr. Hyde.

Mr. Hyde. No questions.

Mr. KASTENMEIER. Let me rephrase what I tried to somewhat discern from you at the outset. You have two interests. One is, protect proprietors of published works, no matter what legislative device may go through to give protection to this particular industry. And the second, which may be completely compatible with the first, is the larger point of what should an appropriate vehicle be, not merely should it have a disclaimer saying something like, "Copyrighted in a mask" or "mask work shown," then do or affect any other copyright of any other author for some other language.

The question really is, what should the vehicle be? Is this, in fact, a copyright in a normal sense, or should it be what we talk about and have talked about for 3 years of design debate. Even the authors of the legislation, concede that this is not typical copyright, because they've only asked for a term of 10 years. They could see that this was not normal copyrightable material, in terms of protection.

Would you be more comfortable, conceptually, if it were treated as design legislation, much as the old design proposals affecting lamps and other things in the *Mazer* case we used to talk about in the last two decades? Is that what you would like it to take the form of?

Mr. BAUMGARTEN. Yes, sir, but may I add, Mr. Chairman, that I don't think one would have to wait for the passage of design legislation and include chips in it. One could just as easily start design legislation with chips. With that qualification, yes, that's what we're talking about.

Mr. KASTENMEIER. I think the sponsors of the legislation fear, again unnecessarily, that that would impair movement of the legislation. I don't know if I speak for them, but if it were the case, that this could take the shape of design legislation and be opened up either by analogy or by actual inclusion to other forms of designs—and we have talked about many forms, the ability designs and typeface and all forms of design which could either be included or not included, that nevertheless someone who's been in the Copyright Office and looks at the field more generally—would that be the way to go?

Mr. BAUMGARTEN. Understanding that I'm now representing AAP and not speaking as the General Counsel of the Copyright Office, the chairman has a very good memory. You mentioned typeface design with very good reason. The publishers had a very difficult time with copyright for typeface. I'm not unconcerned about this, that it might slow things down. But if someone desired to go forward with chip design legislation, I've worked with this committee and its staff long enough to know that it's hardly beyond their ability to accomplish well-fashioned and rapid passage.

Mr. KASTENMEIER. Yes; I think I tend to agree with that analysis. If you have any feeling for it, what do you think the turnoff point would be?

Mr. BAUMGARTEN. I don't purport to be an expert in this area. I think the chip industry has settled on 10 years as an adequate length of time for chip, and I don't question that.

Mr. KASTENMEIER. What does the design legislation hold for turnoff?

Mr. BAUMGARTEN. I don't recall specifically, but we can supply that.

Mr. KASTENMEIER. I think it's something like 7 years.

Mr. BAUMGARTEN. Something like that.

Mr. KASTENMEIER. May I ask this. From your experience as General Counsel with the Copyright Office, is there anything under H.R. 1028 that would preclude or hinder that Office from satisfying its obligation of the bill?

Mr. BAUMGARTEN. I don't believe so.

Mr. KASTENMEIER. OK. Going back to the other question of designs, using a design concept for protection for semiconductor chips, are there dissimilarities between design protection for semiconductor chips and other utilitarian under the *Mazer* case?

Mr. BAUMGARTEN. It's somewhat inaccurate to refer to the *Mazer* case or some of the other illustrations that were given in Congressman Mineta's statement. In the *Mazer* case, the work was held copyrightable on the grounds that it was clearly a work of art, though it happened to be embodied in a statute.

Mr. KASTENMEIER. I should not have referred to the *Mazer* case. I guess I should have referred to the design legislation that followed out of that.

Mr. BAUMGARTEN. I believe that there may be some differences that would require legislative adjustment. There were references, for example, in the design bill to commonplace symbols and the like, which may not be particularly appropriate to the configuration of the chip, since some may be designed as a series of rectangles, even though they go from the surface to the subsurface. I believe there may be points of language in the design bill that may require changes, but I believe the overall objective of the bill, to give protection without the long and costly experience of patent prosecution, may be appropriate to chip protection.

Mr. KASTENMEIER. One of the reasons I raise these questions is because the gentleman from California, Mr. Moorhead, has introduced a bill on general design protection and this may be relevant in the same terms.

Mr. BAUMGARTEN. I believe we referred to that in our statements.

Mr. KASTENMEIER. I don't have any further questions. You have been very helpful, and I thank you very much.

Mr. BAUMGARTEN. Thank you.

Mr. KASTENMEIER. Our final witness today is F. Thomas Dunlap, Jr., who is secretary of the Intel Corp. Mr. Dunlap worked in the industry for 9 years as both an engineer and an attorney, and we welcome Mr. Dunlap. You may proceed as you wish.

You might identify your colleague.

TESTIMONY OF F. THOMAS DUNLAP, JR., CORPORATE COUNSEL AND SECRETARY OF INTEL CORP., SEMICONDUCTOR INDUSTRY ASSOCIATION, ACCOMPANIED BY RICHARD STERN, COPYRIGHT COUNSEL

Mr. DUNLAP. Yes, I am accompanied by Mr. Stern, who is our copyright counsel here in Washington.

[Complete statement follows:]

TESTIMONY OF F. THOMAS DUNLAP, JR., CORPORATE COUNSEL AND SECRETARY OF INTEL CORP.

I represent Intel Corporation, a manufacturer of semiconductor chips and the Semiconductor Industry Association (SIA) an industry association comprised of chip manufacturers and users. I appreciate the opportunity to appear before this committee and explain the technology which the Semiconductor Chip Protection Act of 1983 ("the act") is intended to protect from piracy.

CHIP TECHNOLOGY

The Semiconductor Chip Protection Act of 1983 gives copyright protection against pirates copying semiconductor chips (also known as integrated circuits). These chips are collections of transistors formed on single structure which work together to perform a particular electronic function. The latest generation of chips on the market today contain upward of 250,000 transistors which are compacted on a quarter inch square area of a silicon wafer. These chips have more computing power, compute faster, are more reliable, consume far less power, and sell at a fraction of the cost of the mainframe computers built in the 1970's.

The most advanced semiconductor chips can be broadly classified into two categories: microprocessors and memories. The microprocessor is often referred to as a "computer on a chip" because it has logic circuits capable of electronically performing various information processing functions. It serves as the "brains" of much of today's electronic equipment. A memory, on the other hand, is a semiconductor chip who's function is simply to remember certain data. This data could be the input to the microprocessor. That is, it could be data upon which the microprocessor will operate. It could also be the output of the microprocessor, i.e., data which the microprocessor has already operated on and which needs to be saved for future computations. Of course, the functions of a microprocessor and a memory can be integrated on the same semiconductor chip.

A typical use of a semiconductor chip could be to control the flow rate of fuel into a automobile carburetor. The semiconductor chip would be programmed to maintain a particular flow rate. A sensing device would measure the actual flow rate and provide data to the semiconductor chip which would compare the actual flow rate to the desired flow rate. The semiconductor chip would control the opening or closing of a valve to adjust the actual flow rate to make it equal to the desired flow rate. These types of semiconductor chips are used today in various electronic equipment such as automobile fuel and emission control systems, robotics, minicomputers, mainframe computers, calculators, telecommunication equipment, electronic games, medical equipment, wordprocessing equipment and computer aided design/computer aided manufacturing equipment (CAD/CAM), and of course, the personal computer.

TECHNOLOGY

The basic building block of a semiconductor chip is a transistor. A transistor is an electronic device which is capable of amplifying electrical signals and acting as an electrical switch. These transistors are then connected (integrated) to form a particular circuit which performs the electronic function desired by the chip designer. The transistor is fabricated on a material known as a semiconductor. Semiconductors can act as electrical insulators or electrical conductors depending on the electrical state of the semiconductor. Since a transistor can conduct or not conduct, and the properties of the semiconductor can be adjusted by "doping" the semiconductor with certain impurities, it is referred to as a semiconductor.

PRODUCTION OF A CHIP

Transistors and chips are formed on a thin semiconductor substrate (typically silicon) which is known as a "wafer". Typically, it is a 5" diameter disk approximately .025 inches thick. Approximately 100–200 chips will be made at one time by processing a wafer. The wafer will be subjected to certain chemical, photographic, and heat treatments. Figure 1a–1e shows a cross section of a typical transistor. The fabrication of a simple transistor would be as follows:

(a) Grow a thin oxide over the entire surface of the wafer (see Figure 1a).

(b) Next a thin layer of photoresistive material ("Resist") is deposited on top of the oxide. It will now be necessary to selectively remove certain portions of this resist as well as the underlying oxide so that the silicon surface will be exposed (see Figure 1b). This is done by imprinting a pattern on the resist to develop certain areas of the film while leaving other areas undeveloped. The entire wafer is then dipped in chemical baths and the undeveloped resistor and the underlying oxide can be etched away but the developed resistor will not be etched away and the underlying oxide will be protected. It is these patterns that allow a layout designer to connect 250,000 transistors in the appropriate manner on a single chip. It is these patterns that the Semiconductor Chip Protection Act of 1983 is intended to protect.

The 3 dimensional set of patterns which appear on the actual chip are called "mask works" in the ACT. When the single patterns (or portions) are embodied in other forms which are necessary to manufacture the chip, they are called "masks" in the act.

(c) Portions of the silicon substrate are now exposed and certain impurities can be deposited onto the substrate or directly implanted into the substrate (see Figure 1c). These impurities (typically boron, phosphorus or arsenic) will change the properties of the silicon substrate.

(d) Now a layer of conducting material such as polysilicon or metal is again deposited over the entire surface of the wafer (see Figure 1d).

(e) The polysilicon is then selectively etched away similar to the manner that the oxide was etched away. We are left with a basic metal, oxide-semiconductor (MOS) transistor (see Figure 1e).

The actual production of a chip will require many additional iterations of this selective etching process to allow connection between the transistors and to the customers system.

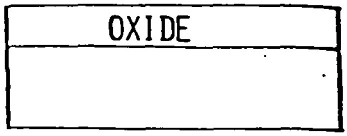

Figure 1.a

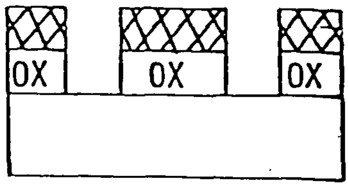

Figure 1.b

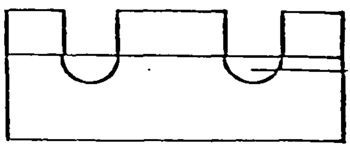

Figure 1.c

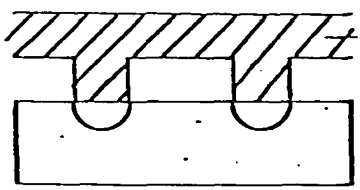

Figure 1.d

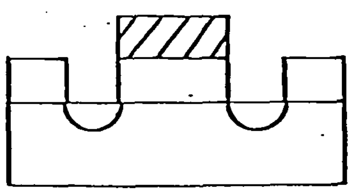

Figure 1.e

Figure 1.

When the wafer is completely processed, it will have 100-200 identical chips which perform the same basic functions on it. Only a fraction of these chips will be functional. A top view of a typical wafer would look as follows:

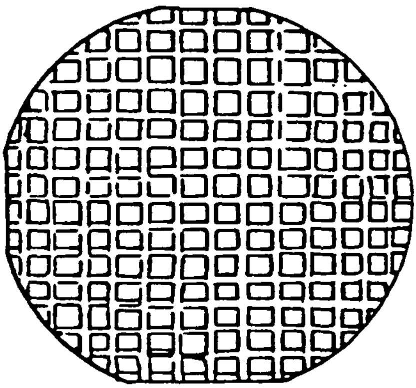

Figure 2.

Each chip is then tested by a computer to determine whether it properly performs the desired electronic functions. If a particular chip is good the tester moves on to the next chip. If a particular chip is bad it drops a spot of ink on the chip indicating that it is to be rejected.

Next, the chips on the wafer are separated from each other. The rejects are thrown away and the good chips are assembled into a package and shipped to the customer. Attachment 1 shows a picture of an unpackaged chip 50 times its actual size and Attachment 2 show a packaged chip which is capable of being used in a customer's system. In this form the chip can now be used in automobiles, computers and the like.

HOW TO DESIGN A CHIP

A chip manufacturer must first conduct a marketing study to determine the functions which its customers would like the chip to perform. Once the functions of a chip are defined, it is the job of a circuit design engineer to develop a circuit to implement these electronic functions. The circuit engineer develops the circuit by making a "schematic" representation of the manner in which transistors must be connected to implement the appropriate electronic function. Often 20 sheets of paper will be used to draw the entire schematic of a complex chip. The schematic would be drawn on paper and look as follows:

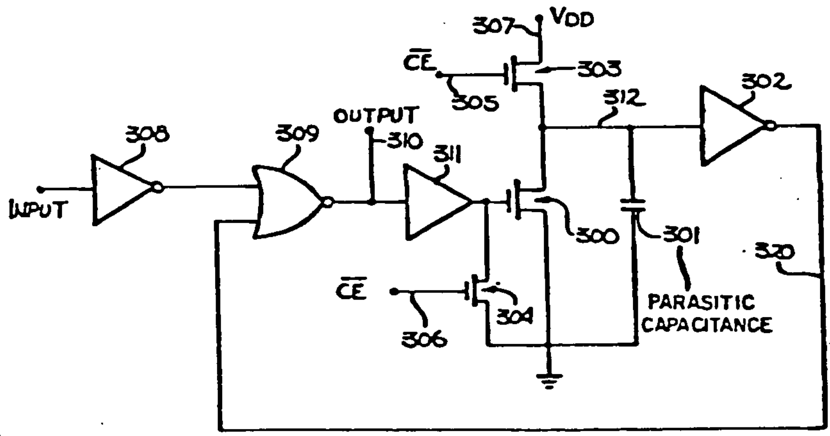

Figure 3.

The patent laws are available for protection of these electronic circuits provided that the circuit meets the useful, novel, and nonobvious requirements for the patent laws.

The circuit schematic is a paper document and is not useful until it is fabricated on a chip. A layout design engineer must take the circuit schematic and layout patterns which can be imprinted onto a wafer to form a chip. This is a very expensive and time consuming process. Typically, this layout will not rise to the level of invention required by the patent laws. The layout must be done in a timely manner so that the final chip can be available in the market place when it was needed. More importantly, the layout must be very compact to minimize the cost of the chip. The smaller the chip, the more chips which can be put on a single wafer and consequently, the better chance that the wafer will yield more good chips. The layout will be retained on a magnetic tape. Attachment 3 shows the 8 patterns used to manufacture a typical chip having 150,000 transistors on it.

METHODS OF TRANSFERRING THE PATTERN FROM THE DATA BASE TO THE WAFER

The original method for transferring these patterns from the tape to the wafer consisted of converting the tape to glass reticles, converting the glass reticles to glass or chrome masks and then using the mask to imprint the pattern on the wafer. The tape is entered into a computer which converts the information on the tape into a glass reticle. A reticle must be made for each pattern which will be printed on the wafer. A reticle is referred to as a "Mask" in the act. The actual reticle is typically 10 times the actual size of the chip and has a single chip imprinted on it. The pattern which would appear on a reticle are those shown in Attachment 3.

Next, a working mask is made from the reticle. The act includes these objects under the definition of masks. One mask must be made for each pattern. The masks are glass or metal plates and multiple copies of the same chip are contained on the mask. The pattern is now the actual size which must appear on the wafer. The mask are placed in a printer which is basically a camera. The camera prints (i.e., projects light through) the mask and the pattern is then imprinted on the entire wafer. Multiple chips are imprinted at the same time. The set of all patterns successively imprinted is referred to as a "mask work" in the act.

The technology for imprinting these patterns has advanced to the point where the generation of the working mask can be eliminated. This can be done by the use of a "stepper" to imprint the pattern on the wafer. This is typically a more expensive manufacturing step but it is also more accurate. When a stepper is used, the tape is again used to make a reticle for each pattern. As before, the reticle has a pattern for a single chip on it. The reticle is placed in a printer known as a stepper. The pattern is imprinted on the wafer one chip at a time and then it is "stepped" to the adjacent area of the wafer where another chip is imprinted on the wafer.

The newest technology eliminates the reticle. This is a even more expensive manufacturing process but it is even more accurate. The tape is entered into a direct write machine. The direct write machine writes the pattern directly onto the wafer similar to the way a picture is written on a television screen. The machine then steps to the adjacent area of wafer and writes the pattern for another chip. This is covered in Section 4 of the ACT, specifically Subsection (6)(D).

THE COPIES WHICH WE NEED TO PROTECT

Today, many techniques exist to minimize errors in creating the pattern of the circuits. There are computer aided design programs which assist in comparing the circuit schematic to the layout before it is imprinted on the wafer. Nevertheless, it is very rare that a chip having upward of 250,000 transistors on it will work the first time. Inevitably, there will be errors in the circuit design, the layout, or the interreaction between the layout, the circuit design and the wafer processing. It is only after numerous iterations at a cost of millions of dollars that the chip is fully functional and can be sold publicly to customers.

The pirates want to obtain a copy of the pattern only after all of these iterations have been completed. In this manner the pirate can minimize his overall cost. The goal of the pirate is to eventually obtain a copy of the pattern in the form of a tape. The pirate can convert the tape to the various different forms of the pattern needed to manufacture the chip.

The pirate's first problem is that these patterns are considered highly valuable property of the company which originally designed the pattern. Consequently, the paper layout, the tape, the reticles and the working masks are carefully protected by the designing company. They are treated as trade secrets within the company and strict security is used to insure that only employees having a good business need for the patterns may obtain access to them. Subcontractors are often used to convert the tape to the reticles and the masks. Again, there is a strict secrecy agreement between the designing company and the subcontractor. Consequently, the pirate cannot easily get access to the pattern in these formats. Other than stealing the pattern, the only practical way that the pirate can get access to the patterns is from the publicly available semiconductor chip itself.

Since the patterns are imprinted on the wafer (the mask work) to form a semiconductor chip, the job of the pirate is to reverse this process. He starts with a publicly available semiconductor chip which has been assembled in a package. He must remove the lid or plastic covering of the package so that he may get access to the actual chip. Now, he makes a careful photograph of the top pattern of the chip. He carefully blows up this photograph of the chip and draws it on paper or on a computer, just like the original layout design engineer did. The difference is that the pirate has a simple mechanical measuring job as opposed to the original trial and error exercise to minimize the layout which the original designing company had to perform.

Once the top layer has been carefully measured and the information preserved on paper or a tape, this top layer is carefully etched away until the next pattern is exposed. Now this pattern is carefully measured and drawn in the same manner. Each pattern is carefully measured and etched off to exposed the next pattern until every pattern of the chip has been copied. The pirate will now have a tape containing the key patterns which can be converted into the various formats which are necessary to manufacture the chip.

A FAIR REVERSE ENGINERING

Under current copyright law, a copyrighted biography does not prevent a second writer from writing a biography on the same person. The second writer must use different words in the expression of the second biography. The second biography cannot look like the first but the same information could be conveyed. This is analogous to reverse engineering.

The Semiconductor Chip Protection Act of 1983 is intended to protect the photographic copying of the chip but otherwise allows reverse engineering. There is a marked difference between fair reverse engineering and the chip piracy described above. The act of fair reverse engineering could involve the reproduction of the pattern from the semiconductor chip but would not allow this pattern to be substantially copied for use in the production of a semiconductor chip. Instead, the pattern would be used solely for the purpose of teaching, analysis of the chip or evaluation of the circuit concepts or techniques embodied in the chip. A reverse engineering firm should be allowed to analyze the chip, draw a circuit schematic of the chip, and then layout a different pattern. This pattern could be used to fabricate a version of

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the semiconductor chip which is functionally equivalent to the original chip but has different visual patterns on it. The reverse engineering firm could then improve the performance of the chip, reduce the size of the chip and reduce the overall manufacturing cost of the chip. However, this type of cost reduction and performance improvement is also engaged in by the original designing company. Here we have a true cost reduction or advancement in the state of the art.

ECONOMICS OF PIRATING

So far we have been discussing the design and manufacture of a single semiconductor chip. In reality, a complete family of chips are needed so that the customer can develop a complete system. This means a total development would include a main chip, additional chips which are used with the main chip, computers to help the customer develop software to be used with the chip and certain software products to work with the family of chips. The manufacturer must also develop a market for this family of chips. The cost associated with developing this market into a substantial base of customers will often cost nearly as much as the Research and Development Cost. Typical cost of a complete family of chips would be as follows:

	Millions
Research and Development cost associated with the main chip approximately	$4
Research and Development of additional chips, development tools and software	40
Subtotal	44
Market development cost	36
Total cost	80

Even after a complete family of chips are developed, the Research and Development Cost of upgrading the chips and correcting errors in the chips continue. These costs often run in the area of $10M dollars a year for a complete family.

As discussed earlier, it would be perfectly legal for a company to reverse engineer any part of the chips. Although it may cost $80M dollars to develop the complete family of chips and the main chip cost $4M dollars, it will only cost about $1M dollars to reverse engineer the main chip itself. This is something that the industry must accept.

The typical pirate will simply pick the high volume products in the family of chips and make photographic copies of these. He does not have to copy the entire family, only the main chip. A simple photographic copy of the main chip would only cost about $100,000. The pirate has minimal research and development cost and virtually no market development cost. He enters the market after the original company has fully developed the market. The pirate does not have to recover the research and development cost of the entire family of chips and certainly does not have to recover any market development cost. He is simply interested in making a profit above his manufacturing cost of the chips that he copies. The pirate simply uses price as his weapon.

The abilities of these pirates to copy particular chips within the family of chips dramatically reduces the incentive of the original company to continue to invest in research and development activities. In fact, every chip must be evaluated in light of the risk to chip piracy. As a consequence, many innovated ideas for design of new chips must be cast aside because the return on the investment cannot be justified in light of the threat of chip piracy.

SUMMARY

Under the current copyright law it is not clear whether or not the printing of the pattern on the wafer is a copy. It is even less clear whether or not copying the mask work from the physical/useful chip is a copy under the current law. The bill makes it clear that the valuable masks and mask works are protected even though they may not be copies under the principles of current copyright law. It has taken the SIA 4 years to agree on this extention of copyright law to protect chips. It is our belief that this is the only practical method of protecting our valuable patterns.

The Technology to be protected by the Semiconductor Chip Protection Act of 1983 is the expression of the chip in a particular visual pattern. The masks and mask works would be protected from photographic copying. However, the same electronic functions could be implemented in a chip so long as different patterns were used.

Mr. DUNLAP. Thank you, Mr. Chairman and members of the committee for an opportunity to talk to you this morning. And I ask that my written testimony and a number of articles on the protection act be introduced. As you indicated, I represent Intel Corp. I also represent the semiconductor industry, which is a group of 57 semiconductor manufacturers and users including the large manufacturers in California, Texas, and large computer companies.

I am going to try to explain the basic process of how to manufacture a semiconductor and, in doing so, explain what a copy is under the new technology, the semiconductor technology, and explain what we consider a copy, which is a little bit different from what our Founding Fathers had in mind when they wrote the Constitution.

And I would like you to keep in mind that there is a minority of intellectual property bar which believes that the chip topography can be covered under the current copyright law. I indicated that is a minority. There have been a couple of suits under the current law, but none of the plaintiffs have thought it worthwhile to go far enough in suits so that no court has actually ruled on this subject.

I would like to use a projector [slide presentation].

First of all, I would like to show you what is a chip.

Mr. KASTENMEIER. May I inquire, Mr. Dunlap, how this may be reflected in the record?

Mr. DUNLAP. That which is shown visually on the screen is also reduced to writing and will be made available to the reporter. (See app. 2 at p. 365.)

Mr. KASTENMEIER. I think we will dim the lights. People in the room who can position themselves to see the screen are at liberty to do so.

Mr. DUNLAP. First of all, I want to show a chip. This is really what the user is going to see. In other words, these are the different pins where you get your electrical impluses, and this is the form that would go into your automobile, your robot, your calculator or whatever. And I also have taken the lid off it, and you can see it is the actual silicon.

OK; so now a chip is a collection of transistors on a single structure, and they all work together to perform a particular function. And so they can perform the measurements of fuel, measurement of emissions. They can perform movements of the robot and all these different things that I have listed here.

Now, the basic building block of the chip is the transistor. This is what is actually going to perform the functions. And this transistor is typically fabricated on a semiconductor material known as silicon. That is how we get Semiconductor Chip Protection Act.

The chip itself then is made by starting with a thin substrate here which we call a wafer, which is typically silicon. So it would be shiny like this side when it is unprocessed silicon. We are going to put it through a number of chemical and photographic and heat processes in order to make chips on it.

So on this side is what a finished wafer would look like. So you start out with this basic bare wafer. And now you're going to go through some processes where you're going to grow a layer of oxide. Then, you're going to put down a photographic material which we call resist. Resist is sensitive to being exposed to light.

So what we'll do now is we will basically take a picture on this resist. We will shine light on the wafer. Certain areas will be exposed to light; other areas will not be exposed. And then what happens is the areas that were exposed become very hard. The areas that were not exposed are still soft.

And so what you do now is subject the wafer to a chemical process and etch away the areas that were not exposed to the light. And so you make these patterns [indicating]. This is a very simple one-step example. You go through eight steps, and you make maybe hundreds of thousands of these on a single chip. But the basic idea of imprinting this pattern is what we're trying to protect.

Mr. SAWYER. Does the chip have to be silicon or can it be something else?

Mr. DUNLAP. In the early days it was germanium. It can also be saffire.

Mr. KASTENMEIER. Why is it a semiconductor chip as opposed to a conductor chip?

Mr. DUNLAP. Because what will happen is it has the ability to either conduct or not conduct.

If I go on with the process, the silicon is exposed here, and you will put in impurities. For example, you put in either boron or arsenic in here. And then you will be able to put electric potential up here. And in the normal state this, what we call will be a source and a drain here of impurities, but they can't communicate, so it does not conduct. But once you put some potential, some electrons on here, now it can conduct. And so they form a channel here, and so that's how they get semiconductor. Sometimes it conducts and sometimes it doesn't conduct.

Now, how do you design a chip? The first thing you have to decide is what it is going to do. You have to do a market study and understand what your customer wants for his computer. And somehow your marketing people determine that you want the chip to do a specific function. So you get a circuit designer who is going to develop an electronic circuit and represented in what we call schematic function. So he is going to represent it like this.

So he understands what this particular device will do, and this type of circuit diagram could be protected by patent. That is, the function that it is going to perform could be protected. This is not the subject of the copyright.

Now, in actual schematic—I mean this is just a very simple one—but an actual schematic of the chip that I showed you is much more complicated here, as you can see. It is many more lines, many more gates. And this is 1 page out of 20 pages. So you've got 20 pages of this to come up with a chip that has 100,000 transistors or so.

But at this point you have got nothing but paper. So you're going to have to take this paper and put it into a form which can eventually be made into a pattern which will be printed on the chip.

And so now we have a layout designer who is going to take this circuit, and he is going to draw it out into a group of patterns which can be imprinted on this wafer. And this is what we are going to call mask work.

And I have here a drawing of a mask work. This is 20 times the size of the original chip. They draw it out like this. And it has different color for each of the layers. So there's eight different layers—well, I think it has six different colors, because some layers are not shown.

And this is really what we are trying to protect, not the chip. But we're trying to protect this picture. OK. So you take that layout [indicating], which you're going to have to put on the silicon. Sooner or later you take that layout, you embody it in a magnetic tape because that's easy to manipulate. You don't want to keep redrawing the thing.

And from there we're going to make a mask. And this mask will be either glass or metal plate—in this case it's metal—for each pattern, for each layer. And you then are going to be able to take a picture of the chip.

So you get this printer, we call it. You put this in the printer, shine light through this mask, and this is the actual size now. You see it will match up exactly with the wafer. And then light comes through certain areas and does not come through the other areas exactly like that does.

OK; now, if I could ask you to use your imagination for a moment, we're going to pretend this is the silicon. This is the wafer. OK. And this is the printer that I talked about. And these are the exact same thing that I showed you there, the same pattern that a mask would create. So what happens is we're going to take these pictures. So the first thing you do is you put down this layer. And again it's projected on the silicon. And then the areas here which you see in red would not be exposed. They'd be protected from the light. In the clear areas, the light would go through, and therefore you could etch away the material underneath and put the second layer down and then the next layer.

And then you just keep doing this process until finally you'll come out with the same pattern that we had before. This is exactly the same pattern that's on the chip. And that's exactly how you make a semiconductor chip.

Now, I want to stop here for a minute and indicate that the Copyright Office has in the past accepted these mylar prints as engineering documents. They have accepted them for copyright. They have also accepted the masks.

But the problem is that they have not accepted the chip. And my concern and the reason that we want the copyright law is to make clear that this pattern is protected. This form or any of those forms, are not available to the public. We treat these very carefully. These are important trade secrets. The only way you could get at the pattern is from the chip.

So we want to extend the idea of copying two ways. One way is that when I project light off of here onto the screen or onto the silicon, that's copy No. 1. No. 2 is the reverse of that, which is when a potential pirate who doesn't get access to this but gets access to the chip. When he takes that pattern and just measures it and draws it back on that drawing, that is a copy, because now what he has done is reverse the process. He's going to take it from here, from the silicon, put it back into this form, and then get it into the mask. And then he'll compete with us, and he hasn't had to design it.

OK; so how to copy a chip is the next important issue. In section 41 of the bill, embodying the pattern in a mask work is defined. That's what you're not going to be allowed to do. The pirate will not be allowed to take the mask work—that is, the patterns which are on the chip—and put them in a mask and then copy it. The chip I just showed you, is available publicly; it has to be. It's easy to pop the lid off. Now he takes a photograph of the chip and he very carefully measures this top layer. Then he goes through a chemical process and etches it away.

Now he's got another layer exposed. He measures this layer, etches it away. Then he just keeps doing that until he has completely reversed the process. And that's much easier than designing it in the first place.

Mr. SAWYER. Is that original drawing done by hand, the one that you started copying with?

Mr. DUNLAP. OK. The original drawing in the early days was done by hand, but now we have computer machines that do it, so that the layout person would draw it on a machine, just draw it on a computer just like you would type into a word processor today. And then it would be converted by the machine into a printed form.

Mr. KASTENMEIER. Obviously, it is easier to remove these layers, these etched layers, than it is to design it. But it is still not easy for a pirate to do an entire chip, is it?

Mr. DUNLAP. It's relatively straightforward. A chip—let's take that chip there, which maybe would cost you $4 million to design, the pirate can do it for $100,000.

Mr. KASTENMEIER. How much time would it take?

Mr. DUNLAP. It would take maybe 3 years, 3½ years to do originally, and 1 year, maybe 1½ years for the pirate to do it.

Mr. KASTENMEIER. It takes them 1 year, 1½ years to do it?

Mr. DUNLAP. I am sorry. I guess I was thinking of reverse engineering. I am thinking of the actual case of this chip. It was not copied. To do reverse engineering would take 1½ years. To do just straightforward copying like this would take 3 to 5 months.

Mr. FRANK. The chips you said are designed for a specific user so that the pirate would then go and undersell the original manufacturer to that particular user? What does he do with the chips once he pirates it?

Mr. DUNLAP. Once he pirates it——

Mr. FRANK. I thought you said the first step is to see what the customer wants.

Mr. DUNLAP. Right. The right customer.

Mr. FRANK. Because that is the application.

Mr. DUNLAP. Sure. I would like to at this point go to two of the questions that were asked of earlier witnesses. I think you would have a better understanding of what we're talking about if we answer them now.

The first one is the case referred to, the *Midway* case. That really did not talk about this entire pattern here. What that case was primarily about was a rom-code. What it really involves is taking software, which is copyrighted, and putting software into silicon. So in the case of this chip, if someone copied this chip, we would be protected since we have software in this chip. And as you can see, this area here is relatively random. It's just a bunch of functions, but they all look different. The design is all different. This is regular [indicating].

And the reason is this is what we call memory. All it can do is remember 1–0; it either has charge on it or no charge on it. There are a number of bits in there. So the *Midway* case refers to when you put the program in here, when you fill this up with a bunch of 1's and 0's, is that protected? And I think the majority of the courts say yes, it is. The software in silicon is generally protected.

So this particular area today is probably protected. The rest of this is what's not protected. The rest of this is the random portion that has no software, and it's designed by painstakingly having the designer lay out this electronic function into this pattern.

The other question from Mr. Kindness was with respect to a book. OK. You could take the contents of a book and convert it into 1's and 0's, electronic impulses. So, for example, today you don't write a book in handwriting, you don't write it on a typewriter; you probably write it on a word processor. Well, with a word processor, what you do is you take the words and convert them into binary signals, into 1's and 0's, and you store it on a diskette of some type, magnetic material. What could conceivably happen, instead of storing the 1's and 0's on a magnetic material, you could store the 1's and 0's in silicon.

But again it's the expression of the book which the author wants to protect. It doesn't matter whether you store it in words or you store it on paper. You store the words on a magnetic media or you store the words in silicon. It's all the same expression of the book. And I think the Chip Protection Act would not affect that at all.

Mr. KASTENMEIER. If you did store it in the chip you would have, you could also erase it and remove the bits of information that it has in there?

Mr. DUNLAP. Correct. Actually, in some chips you can and some chips you can't. It's the kind of thing—well, let's take a calculator. A calculator always has to be able to add and subtract. How do you add and subtract? You put it in there with what we call read-only memory, which means you can always add and subtract.

But on the other hand, you don't know what numbers you're going to add and subtract. So when you put the numbers into the calculator, you have to be able to change them. So that memory is called random access, which you can change. So some you can change and some you can't change. Some you can change if you expose it to light, which is what you call an eprom.

Mr. KASTENMEIER. Most of these chips have a a certain storage capacity. If you try to store in a chip more than the capacity, it just will not take the information in bits. The chip may not be able to easily eliminate as you put on this tape that which was previously stored.

Mr. DUNLAP. That's right. But this chip, when you're talking about capacity, you're talking about a memory. So it means in this particular chip you would only be talking about this area. There is a certain capacity. All this is just random logic. It doesn't have any capacity.

OK; now, the other thing that has come up a number of times and came up this morning is what we call reverse engineering, which has been a concept understood in the industry which has always been considered perfectly fair. This is the equivalent to individual rights of a copyrighted biography. You can get a copyright in a biography.

A second writer can still write a biography about the same person; he just can't use the same words. He has got to express it in a different manner. And so with a chip, we want to take the same concept and just apply the normal fair use doctrine to fair reverse engineering.

And the way you do that is you don't copy the thing directly for a mere $100,000; what you do is you study the operation of the chip. You take that chip and you say, how does it work? We publish what the specifications are, and the guy says, OK, I can do that better than they did it.

And so you can implement those exact same functions. You just can't do it with that specific picture. You'd use a different picture. And that's perfectly fair in our minds, and I think it's perfectly fair under the normal copyright doctrines. By doing that, you can reduce the cost. You can improve the performance. You have seen how one person did it. The second time around, you're going to do it better.

Now, the difference between reverse engineering and direct copying is that reverse engineering is going to cost about 25 percent of the original design, and it's also going to advance the state of the art. You're going to have a better chip; whereas the copying, you're just directly copy. So you're really not advancing the state of the art. All you're going to do is copy it, manufacture it cheaper, and therefore discourage the design of innovative chips.

The last thing I want to go to is the economics of this thing. The chip is not very useful by itself. You have to have a family of these chips, and you have to have additional products to help the customer design a system.

So the typical cost of a chip family like this one, which happens to be what is known as the 8086, will cost in the neighborhood of $80 million, so that that is broken down to about $4 million, what I call the main chip, which is this CPU, central processing unit. So that was $4 million by itself, but it is not useful unless you have done a study of the market.

So how can a broad group of customers use that so you can sell many of these chips? That is another $36 million. Then you are going to have to develop additional chips, and then you are going to have to develop development tools, which is a hardware system, a computer system, to allow your customer to use that chip, and the software that goes with it.

So this is a major development project which costs about $80 million. It will cost about $10 million, just ongoing maintenance, to solve the customer's problems and upgrade the thing.

Mr. KASTENMEIER. Mr. Dunlap, can you be more consistent than that? Can you give us a case of another company that you sell this to and what this chip will do with the finished electronic unit so that we can actually see how it is integrated into commercial purposes?

Mr. DUNLAP. The most common example is we have a slight variation of the chip which is shown as the 8088. That chip is used by IBM as the brains of its personal computer, its latest personal computer which has just come out in the last year or so. The brains behind that is an Intel chip.

Mr. FRANK. Are there ever times when it makes sense for a company to reverse its own chip?

Mr. DUNLAP. In fact, we do that. We make it smaller. We add functions, and to some extent—the case of the IBM personal computer is an example when we first came out with this 8086 which takes 16 bits of information in at a time and then processes. It gives 16 bits of information out at a time. IBM in the personal computer and a number of other people said, but your last chip had 8 bits, and I did a lot of work with 8 bits, I have a lot of software. So I like the idea that you process 16 bits internally, but I want to give you 8 bits in—convert it to 16 bits for internal use, and give me 8 bits back. You are converting it and using reverse engineering to modify it.

Mr. SAWYER. Would it be fair to say, so that I understand what you are saying, that reverse engineering would be designing around a patent? In other words, we know a light switch turns on and off a light and that is a function, but we could figure out another way to do it mechanically?

Mr. DUNLAP. That is exactly the same.

So reverse engineering. This chips costs about $1 million, takes about 1½ years and improves the state of the art. A direct copy costs about $100,000, takes about 3 to 5 months, and doesn't really advance the state of the art. It is really the same thing.

Now either of these people—they don't have any of this. All they have to worry about is copying this chip, and it is much smaller, but we have developed the market for them and we have developed all the tools. So the customer buys the tools from us, and he buys the cheapest product.

And so, the net effect of this is that if we continue to allow people to copy our more advanced circuits—and there's chips more advanced than this, certainly in design, some in production—what we have to do is we have to say, OK, it is going to cost me $80 million, it is going to cost me $10 million to continue to update. Now what is going to be my return? What are my average selling prices going to be? What are my margins going to be?

And today when we do this, we look out and we say, it is going to take 3 to 5 months to copy it. At that point they are going to substantially reduce the price because they haven't had to invest any of this. They don't have to recover any of these other costs. Therefore, is it even worth doing?

And part of our decision has to be based on a copy coming out of the market. Maybe we shouldn't do the chip. So the ultimate result is we discourage innovation, and maybe the personal computer will not advance because we can't advance the chips.

Mr. FRANK. Is there a gray area between reverse engineering and copying? Would you have to subpena any product?

Suppose somebody made a copy and made just enough changes to make it a new product. Would you then have to subpena them and require them to show a work product?

Mr. DUNLAP. I think there is always going to be a gray area. The majority of cases are going to be straightforward.

Here we have this picture of 100,000 transistors. Is someone going to lay out 100,000 transistors and have them look exactly the same as this? Highly unlikely.

Mr. FRANK. I agree, but the question is can you do a copy and make just enough changes so that you might make it look like you were reverse engineering, but you really weren't?

Mr. DUNLAP. Well, that is going to be the problem. The guy who copies it tries to get around it, and that is what you have to——

Mr. FRANK. Would you then require that the work product be there so that they have to show how they manage to arrive at that, how they get that end product?

Mr. DUNLAP. That is what you have to do.

Mr. FRANK. Do we have to address that? Would that be automatic that the counsel for——

Mr. DUNLAP. Mr. Frank, you have hit it exactly on the head. When there is a legitimate job of reverse engineering, there is a very big paper trail, there's computer simulations, there's all kind of time records, people who have spent an enormous amount of time understanding and figuring out how to make the design.

Mr. FRANK. It is not the extent of the change, but the extent to which the work can be documented and the corrections can be documented.

Mr. DUNLAP. Correct, whenever there is a reversing engineering job, there is a very big paper trail that cannot readily be fabricated.

Mr. FRANK. It would be someone who would do what you do and someone was accused of a copy and the defense wouldn't know if they reverse engineered, then they would have to have the burden of showing if they couldn't produce the paper trail?

Are you against that?

Mr. DUNLAP. The point you have raised is specifically addressed to the other body by Mr. Vadasz, who is an officer of Intel, and with your permission I would like to make that letter that he sent to the other body a part of this hearing also.

Mr. FRANK. I would ask that this be done.

[The letter follows:]

INTEL CORP.,
Santa Clara, Calif., June 23, 1983.

Hon. CHARLES McC. MATHAIS, Jr.,
U.S. Senate,
Washington, D.C.

DEAR SENATOR MATHIAS: I understand that two questions have been raised, concerning S. 1201, on which I would like my comments to be made part of the record.

I am an electrical engineer by training and have spent the last twenty-two years in the solid state electronics area involved in the design and development of semiconductors. As a result of my work, I was made a Fellow (the highest technical position) of IEEE. I received this honor for leadership in the design and development of semiconductor memories and microprocessors. I feel that gives me the authority to speak out on these issues.

First, it has been suggested that a copyright on a set of masks can somehow monopolize electronic circuitry so that later manufacturers will be prevented from using essential designs. In the same view, it has been alleged that any engineer with the requisite skill, working on a given circuit, will tend to converge on a single most reasonable mask layout.

This is completely contrary to the experience of engineers in the semiconductor chip industry. For any desired function, there will always be a large number of different good layouts. A copyright on one layout will not keep engineers from using other functionally equivalent but visually dissimilar layouts. Engineers do not converge on a single most reasonable layouts because no such thing exists. When an engineer creates his own layout instead of copying someone else's, he invariably comes up with something that looks different—probably even to a casual lay observer, but certainly to a trained eye. The likelihood of two engineers coming up with the same chip layout is equivalent to the likelihood of two college students independently writing the same essay on a final exam.

Second, it has been said that even very subtle mask changes may represent significantly different and original designs. This is true. It has been further said that exactly the sort of tests that demonstrate such differences are specifically disallowed as defenses in copyright infringement cases. I do not believe this is true, for I have been informed otherwise. But I feel that evidence of this type should be allowed in semiconductor chip copyright infringement cases and hope that the legislative history of S. 1201 would include a statement endorsing use of expert testimony to show subtle functional differences in circuit layouts.

Finally, a point deserves mention that has a bearing on both of the foregoing points. When a company decides to become a second source for a chip already on the market, it will probably want it to be equivalent to the first chip not only functionally but in terms of specifications and test data; that is, the second chip would be so fungible with the first chip from a production standpoint that it would not make any difference which one was placed into the equipment for which the chip is targeted. In these circumstances, a chip designer may feel that the fewer design or layout changes that are made from the first chip, the less likelihood there will be of a nonequivalence in specifications. This would lead to similarities in layout and appearance, but even when this happens, it is reasonably easy to tell the difference between a slavish copy and a reverse engineering job. Whenever there is a true case of reverse engineering, the second firm will have prepared a great deal of paper—logic and circuit diagrams, trial layouts, computer simulations of the chip, and the like; it will also have invested thousands of hours of work. All of these can be documented by reference to the firm's ordinary business records. A pirate has no such papers, for the pirate does none of this work. Therefore, whether there has been a true reverse engineering job or just a job of copying can be shown by looking at the defendant's records. The paper trail of a chip tells a discerning observer whether the chip is a copy or embodies the effort of reverse engineering. I would hope that a court deciding a lawsuit for copyright infringement under this Act would consider evidence of this type as it is extremely probative of whether the defendant's intent is to copy or to reverse engineer.

Sincerely yours,

LESLIE L. VADASZ,
Senior Vice President.

Mr. DUNLAP. I think that the short answer in terms of the majority of the cases of copying, it is going to be something like obscenity. You will know when you see it.

Mr. FRANK. That would make me very nervous. I like the other—I like the long answer better.

It seems to me there has got to be some way we can avoid that in the paper trail. It seems to me that that ought to be a factor. Otherwise, it becomes too subjective.

So it is not just the nature of the changes, that somebody can maybe counterfeit those or make just a few cosmetic changes and try and have it finished. It is a fact that he would have to show—you would have to show how it is worked out. That would make the difference. I don't think there is much of a paper trail, but I am not an expert.

Mr. DUNLAP. The fabrication of a paper trail like that is almost impossible.

Mr. FRANK. Well, if you do that, you might as well have gone and done the original work?

Mr. DUNLAP. That is correct.

Mr. KASTENMEIER. Presently or in the future, under such a bill could there be an obligation imposed on the part of the original designer to incorporate one or more unique codes that would identify that design as against replication?

Mr. DUNLAP. Well, that is interesting. These chips are so complex that usually the engineers do that for us by accident. They don't try to.

This particular chip was copied. Our design engineers made some mistakes the first time around, and when they fixed the mistakes they fixed them in quick manner. In other words, they put in—in this memory but they had to change some bits. They didn't need some of them. So what they did was they just cut them off so they wouldn't be used. It was a quick way to do it.

The person that copied it copied all these unused things. So they copied our mistakes, which is quite often the case, where they will copy a circuit that has no function.

Mr. KASTENMEIER. That would be a distinction between an original design and replication?

Mr. DUNLAP. That is correct.

Mr. STERN. Mr. Chairman, if I may, the story of that incident is described in a Washington Post story, which you may have read here a couple of months ago. If it would suit the chairman's convenience, we would be glad to make a copy of that story from the Washington Post about copying the mistakes a part of the record in this proceeding.

Mr. KASTENMEIER. Without objection, we will receive that and make it available to the members of the committee.

[The information follows:]

[From the Washington Post, May 2, 1983]

BATTLING TO INNOVATE AND EMULATE: INTEL VERSUS NIPPON ELECTRIC

(By Dan Morgan)

Peering into a microscope at a greatly magnified computer chip one day last August, Peter Stoll of Intel Corp. saw something startlingly familiar. In one of the tiny cells, two transistors were disconnected from the rest of the chip, and dangled uselessly in their bed of silicon.

Stoll, 33, a chip designer, recognized the defect as a small last-minute repair job he had performed on Intel's 8086 microprocessor several years earlier. It had worked, correcting the minor flaw in the chip's logic, and the 8086 went on to become phenomenally successful as the "brain" in a wide range of business computers, robots and industrial machinery.

But what startled Stoll was that the chip under the microscope was not Intel's. It was a product of Nippon Electric Co. (NEC) of Tokyo. Stoll concluded that he was looking at a Japanese copy so perfect that it even repeated the small imperfection in the original chip.

Intrigue of that kind in the $13 billion-a-year global market for computer chips has led to U.S. accusations of unfair Japanese practices, ranging from copying to protectionism. Critics of Japan say that its efforts to gain supremacy in computer chips, perhaps the single most important technology of the Information Age, are typical of the methods employed by "Japan Inc."

"We're at war, no doubt about it," said a computer scientist from a large U.S. research laboratory. "If I had money in 'Silicon Valley,' I'd get it out. . . . It's just like any other war zone."

U.S. politicians are in a mood to strike back.

Democratic Reps. Don Edwards and Norman Y. Mineta, from California's so-called Silicon Valley area, have introduced a bill to give copyright protection to chip designs. They say the measure is needed to stop "pirate firms" from "flooding markets with copied designs that undersell the innovating firms."

But some trade specialists caution that there is a Japanese side to this story. For one thing, U.S. companies are holding their own in the competition.

Japan, whose share of the U.S. chip market is well under 10 percent, has made inroads in some kinds of chips, such as memories, that store information. But the United States is dominant in microprocessors, the "computers on a chip" that serves as brains for computers and controls in dishwashers, jet aircraft, missiles, industrial robots, telephone systems, traffic lights and hundreds of other products.

Many experts insist that Japan's progress is not attributable to copying.

"The basis for the Japanese taking an ever larger share of the [chip] market is not transfer of American technology," said a patent attorney for a large U.S. company. "It's Japanese management, equipment and a degree of cooperation between firms that's prohibited in this country."

Even the issues in the Intel-Nippon Electric dispute about alleged copying of the 8086 microprocessor become fuzzier on closer inspection. Intel contended that NEC wrongfully copied the chip's microcode, the set of internal instructions laid out as a pattern of transistors on the chip's memory. Intel counsel Roger Borovoy said the microcode was copyrighted and could not be used without Intel's permission.

Officials from NEC's U.S. sales company acknowledge that the microcode on their chip is identical to that on Intel's including the flaw engraved onto the original.

"If you're not 100 percent 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," said NEC's David Millet, who is in charge of nationwide marketing of microprocessors.

But NEC officials in Japan and the United States deny that the company did anything wrong, contending that they had a right to produce their own version of the chip under a 1976 agreement allowing both companies to use the other's patents.

NEC officials in this country say the question whether the microcode can be copyrighted has never been decided in court, and Intel agrees. And they say that NEC even sent Intel a 1979 announcement of NEC's version of the 8086.

The story of the NEC-Intel dispute is representative of the suspicion, tension and, often, grudging admiration that characterize the competition between the two countries. It begins with the markedly different cultures and societies from which the two have emerged.

THE ROOTS OF COMPETITION

Compared with the 84-year-old NEC, Intel is an upstart company, an example of American boldness and nerve that began with a few dozen employees in Santa Clara, Calif., in 1968 and grew into a business with 19,000 employees worldwide.

Intel's stock in trade has been innovation. Since it was founded, the company has spewed out first, including the first microprocessor in 1973. A founder, Robert Noyce, is one of the inventors of the integrated circuit, which became a basic component of modern electronics.

Intel is also a sort of corporate melting pot that, like the nation itself, has drawn its brain power from all over the world. Its current president came to America as a refugee from Hungary in 1957; a senior vice presideent was born in Hungary, and an Israeli, an Italian and a Japanese are credited with helping to develop several new Intel products.

NEC has succeeded in typical Japanese fashion: through dogged determination, aggressive marketing and initial reliance on U.S. technology, including that of Intel.

From the outset, NEC had financial and structual advantages over Intel. While Intel makes more than 80 percent of its income from the sale of chips, NEC is a conglomerate that produces computers, electrical equipment and other products. Chips account for less than 20 percent of its revenue, so a temporary decline in that business can be offset by gains in other products.

As a member of the influential Sumitomo industrial group, NEC could draw on the financial resources of the Sumitomo Bank and on the marketing connections of the Sumitomo trading company. But Intel has depended for its financing on the vagaries of the U.S. stock market and bank loans. For most of the last 10 years, Intel has had to borrow money at much higher interest rates than NEC.

Until the early 1970's, NEC was no match for American chip makers. The U.S. computer chip industry was expanding rapidly, thanks in part to heavy government spending on chips for the Apollo man-on-the-moon space program and the Minuteman intercontinental ballistic missile.

In 1973, computer scientists in Intel's laboratory scored a major breakthrough with invention of the first microprocessor. This was a watershed not only for Intel, but also in the history of the information industry.

Until then, chips generally had performed only a single task, such as adding, subtracting, multiplying or dividing. Combining those tasks required wiring together several chips on a bulky board. But a single microprocessor chip could perform all those functions. This meant, for example, that one computing chip could run a pocket calculator, shut off a microwave oven, analyze blood or control traffic signals.

It was possible for general-purpose microprocessing chips to replace more expensive, customized ones previously needed by industry. As microprocessors became more sophisticated, they increasingly began to do jobs that previously had required large, cumbersome computers.

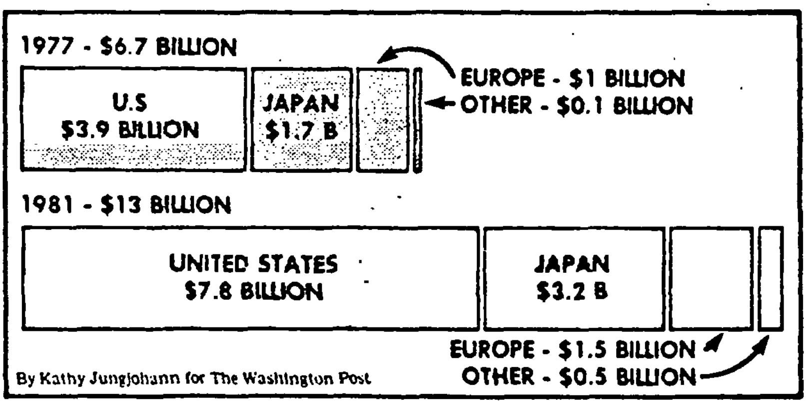
NEC claims to have developed an early microprocessor on its own at about the same time as Intel. This chip, the uCom 4, could handle simple tasks such as operating a pocket calculator. But Japanese officials acknowledge that they have had trouble keeping up with U.S. advances in mircroprocessors. To do so, Japanese companies have repeatedly relied on U.S. patents and "reverse engineering."

Industry representatives make a distinction between reverse engineering, a generally legitimate practice in which one company's designs are used as a model by another company's engineers, and copying, in which imprints of circuitry are taken by using photographic and lithographic techniques.

In the late 1970's for example, NEC produced a version of Intel's 8080 microprocessor, the first chip complex enough to handle word-processing programs. A new generation of microprocessors was making possible the era of small, compact personal computers, and Intel was again in the lead.

Tomihiro Matsumara, NEC's senior vice president for research, acknowledged in an interview that NEC attempted to make and sell its own comparable chip, "but we did not succeed." So, he said, NEC engineers analyzed the 8080, then laid out their own "completely different" version, using NEC manufacturing techniques.

WORLD SALES OF COMPUTER CHIPS



SOURCE: DATAQUEST AND SEMICONDUCTOR INDUSTRY ASSOCIATION

Roger Borovoy, Intel's general counsel until he left the company last month, said Intel had no objection because NEC had used the 8080 only as a model and not "copied" it.

Japan, he acknowledged, was becoming an innovator in chips in its own right. Between 1974 and 1977, the government had poured at least $300 million into a research consortium that included NEC and five other companies. "They had come a long way with their own development. They'd attained a status of their own," Borovoy recalled.

Evidence of NEC's progress came in April, 1976, when Intel and NEC signed an agreement that enabled each company to use the other's patents. In the next several years, Intel was to utilize several NEC patents for specialized types of chips.

By the late 1970's, NEC Hitachi, Fujitsu and Toshiba grabbing significant shares of the world market in memory chips, devices that store information but do not perform the complex tasks of microprocessors. But these companies still had problems with the far more complex microprocessors.

In 1978, a year before NEC completed its version of the 8080, Intel introduced a much more advanced microprocessor, the 8086. It crammed 30,000 transistors onto a quarter-inch-square piece of silicon, producing as much computing power as some 1960's computers that filled rooms. The 8086 could handle not only word processing but also complex mathematics, and it and comparable microprocessors are being used in most sophisticated personal and business computers, such as IBM's popular personal model.

NEC's representatives recognized that the 8086 gave the United States a decisive edge in silicon brain power. In 1978 they approached Intel about supplying technical aid to produce the 8086 in return for a percentage of the money NEC would get from selling the 8086 in Japan.

But this time, Intel turned NEC down. NEC, in the midst of a U.S. expansion program, was preparing to enter the international chip market in a big way. It had just purchased a California computer memory company called Electronic Arrays and was planning a second California facility for making memories and logic circuits.

"We weren't anxious to help our competitor," an Intel official said.

Instead, Intel made a deal with NEC's Japanese rival, Fujitsu. Thwarted, NEC decided to go ahead with a version of the 8086 without special help from Intel.

NEC's Matsumara acknowledged that the resulting chip is "interchangeable" with the Intel version, but he strongly denies that it was "copied." Similarly, Robert Hinckley, an attorney for NEC in San Francisco, contends that NEC had a right to reverse-engineer the chip because of the patent cross-licensing agreement of April, 1976.

NEC officials said it was no secret that they would produce the 8086. Electronic News reported it and, NEC officials said, they sent a copy of their announcement to Intel and received no protests.

NEC, however, had several problems.

For one thing, the Japanese company apparently had difficulties reproducing a version of the Intel device without American help. It was not until 1980, two years after Intel's 8086 appeared, that NEC's comparable chip was sold in the United States.

There was also the problem of Intel's copyright on the chip's microcode, a sort of brain within a brain. It is the part of the microprocessor that takes electronic commands from a keyboard and tells the rest of the chip's parts what to do with the commands and in what sequence.

Like a video-game cartridge, the microcode is a computer program that has been written by a programmer and then is built into the chip. In a Pac Man videogame, the microcode tells the Pac Man what to do. In a microprocessor, the microcode tells a computer what to do. Although the microcode appears in the 8086 as hardware—a pattern of 10,752 tiny transistors—Intel maintains that it is not a mere piece of electrical circuitry but is "intellectual property" covered by copyright law.

Copyrighting the microcode had seemed to Borovoy a way to protect the company's intellectual effort from infringement. Borovoy said his "knees wouldn't shake" at bringing a lawsuit against a company that copied Intel's microcode.

But Hinckley, NEC's San Francisco attorney, said no cases have been adjudicated establishing any company's copyright claim on such material.

"Copyright is designed to protect works of authorship—artistic works—and we don't think microcode qualifies," he maintained.

Whatever the merits of their respective cases, NEC and Intel reached a settlement on the 8086 in March after several months of negotiations and without litigation. Borovoy, who said he could not discuss details of the settlement, said the agreement would save hundreds of thousands of dollars in court costs.

THE BATTLE FOR MARKET SHARE

But the dispute over 8086 is seen at Intel as only one chapter in what will undoubtedly be a continuing battle.

"The Japanese see themselves locked in a warlike struggle, determined single-mindedly to reach their objective by any means, regardless of the impact on the U.S. . . . It's going to be a very, very bloody battle out there," Intel's Noyce said.

He argued that Japanese tactics have denied American companies, the fruits of their innovation, profit that enable them to pour money into creating new technical breakthroughs needed to maintain the U.S. lead.

U.S. studies have accumulated a mass of evidence buttressing Noyce's contention that the Japanese government has shielded local chip companies from U.S. competition while they prepared for an onslaught on traditional U.S. markets. U.S. companies have never been able to capture more than 20 percent of the Japanese chip market even when their technological lead was overwhelming.

Before 1978, only Texas Instruments was permitted to establish a wholly owned manufacturing subsidiary in Japan, and even TI had to share some of its patents with Japanese companies to secure that concession.

Few deny that the Japanese challenge is serious. Japan is running a $250 million trade surplus with the United States in chips. And NEC and Hitachi ranked just behind Motorola and Texas Instruments as world leaders in sales last year.

A detailed study issued in February, 1982, by the congressional Joint Economic Committee warned that the main casualties of the relentless Japanese export drive could be small, innovative Silicon Valley companies. With them out of the running, it warned, Japan would be in a position to beat the United States at innovation.

Some industrial experts say the United States should keep its sense of perspective as it responds to Japan's challenge.

Robert B. Reich of the Kennedy School of Government at Harvard University said Japanese chip companies made headway after 1975 primarily because they plunged ahead while U.S. companies, hard hit by the recession, "stood still."

U.S. companies have recently regained some of their lost share of the world market in memory chips and still have an impressive lead in microprocessors. In typical U.S. fashion, Intel is on the verge of marketing an even more advanced microprocessor, the 80386, which the company claims will be far ahead of anything produced in Japan.

Intel has also announced that it will soon sell the first magnetic, bubble-type memory capable of storing 4 million bits of information, the equivalent of 240 typewritten pages.

"Despite trade barriers and protection and copying, we're still winning, although that's no guarantee for the future," said Bob Derby, who ran Intel's marketing operations in Japan.

That, free traders say, should be a warning to those in Congress who want to wield the big stick of government retaliation in the computer chip battles with Japan.

CHIPS: A GLOSSARY OF TERMS

Silicon: the hard, gray, lightweight material from which chips are made. Wafers of silicon are "doped" with impurities in selected places to change electrical properties and affect the path of the current. Lithography is used to imprint tiny wires, or circuits, on a chip's silicon layers.

Transistor: an electrical switch in a chip that can be turned on and off in a controlled way to store or process data.

Integrated circuit: a combination of transistors. The latest generation contains as many as 100,000.

Memory: a chip that stores information.

Microprocessor: a chip that performs some of the same tasks as a computer; the "brain," or control, in hundreds of pieces of equipment, from car engines to computers.

Microcode: a software program that is the permanent set of instructions on a microprocessor chip.

Bit: A single "on" or "off" signal, a single piece of electronic code. It takes several bits together to represent one letter, punctuation mark or numeral.

Mr. DUNLAP. I guess the last point I want to make is with respect to the question of locking the barn door.

People are still copying this circuit, and we are in negotiations with a number of people for copying this circuit.

We have the next generation of these circuits. There's three particular extensions of the families of this, which are just now being sampled, which no one has even had the chance to touch them. So they haven't had a chance to copy them, but they certainly have intentions of doing that.

Mr. KASTENMEIER. Does that conclude your testimony, Mr. Dunlap?

Mr. DUNLAP. Yes, it does.

Mr. SAWYER. Mr. Chairman, may I?

Mr. KASTENMEIER. Yes.

Mr. SAWYER. What is the average, if there is such a thing, life of a computer chip before it becomes outmoded or overtaken by technology? Is there some kind of average that you figure to get your costs back?

Mr. DUNLAP. Yes, absolutely. The predecessors of the chips I showed, the life is probably around 7—5 to 7 years or so, but the newer chips will be much longer. We think that the more complex ones—you are talking about investing $80 million or more—it is going to take more time to get a reasonable payback. Plus, they are more complicated, and they will probably go past 7 years.

Mr. SAWYER. Thank you.

Mr. KASTENMEIER. Mr. Dunlap, I wish you would discuss briefly for the committee in as candid terms as possible why it was that members of your association had reservations in 1979 about copyright protection and presumably they do not now.

Mr. DUNLAP. That is correct. There was a difference of opinion in 1979. The major people have all changed their minds, and we have unanimous support of the Semiconductor Industry Association.

A lot of that, I think, was because it was before its time. I think there were a lot of people who did not recognize the importance of protecting chip designs.

Now since 1979, a number of things have happened. First of all, we have got much more complex microprocessors, not just from Intel, but our competitors as well are designing chips which compete with the chip that I showed you.

And so, they now recognize how expensive it is to design these new chips, and they believe that they need to have protection now, where before they did not recognize the need.

The other thing is we have the specific example of dynamic rams. In 1979, the United States was by far the leader in semiconductors. OK, since then some of the international competitors have copied our chips and have taken away a substantial market share, where today in the 16-K and 64-K dynamic rams we are definitely not the leaders.

There is now going to be in 1984 the 256-K. So we now have a new chance to become the leaders. Part of the reason that we are not the leaders in the 64-K's is that international competitors copied the previous generation, the 4K, and made it four times bigger, just straightforwardly made it four times bigger, and then manufactured it better. That is the end of it. Well, now with the 256 you just can't do that. You have got to come up with some new technology. The industry as a whole recognizes this, that we are more likely to come up with the innovative technology, and we do not want that to be copied.

And then, the reason is there are these limits in the bill which Mr. Edwards explained that limit the protection that was not in the previous bill, the compulsory licensing, and the clarification of reverse engineering.

Mr. KASTENMEIER. I take it the industry is made up of a number of types of companies, almost as in the pharmaceutical industry, where you have research companies and you have generic companies. You have almost the same thing with respect to, apparently, semiconductor chips; there tend to be users themselves or there are those who integrate the pioneer work of others in design of their own. And so at least in 1979 it would appear that some of those very large companies were opposed to this protection insofar as it would appear that it would limit access to new designs that they would have unless they themselves devoted themselves more exclusively or more intensively to designing new circuitries.

Isn't that correct?

Mr. DUNLAP. That is correct. But I think they recognize now that to some extent they are going to have to spend research and development dollars today, and they want to have those protected.

Mr. KASTENMEIER. But I guess what I am saying is that as was the case then, the interest of these conglomerative companies is quite different. Some of the companies are large and diverse, made of many things components. Others are possibly somewhat smaller; they tend to be engaged in research and design and development design, and therefore their interests are somewhat different.

But isn't this still the case?

Mr. DUNLAP. Yes; it is still the case.

Mr. KASTENMEIER. Do you have no dissidence within the association?

Mr. DUNLAP. No; they have now recognized the importance of this. I think actually that the board of directors of the SIA has a letter which they all have signed in support of this bill.

There is one thing I should mention. National Semiconductor was one of the main opponents of the 1979 bill, and their chairman and president, Mr. Spork, who is one of the ones who actually signed that letter——

Mr. KASTENMEIER. And IBM, too, I assume.

Another question: How do you explain the fact that the semiconductor industry has been so successful during the last 15 years without statutory copyright protection?

Mr. DUNLAP. I think we were successful up until the last 2 or 3 years. During the last 2 or 3 years there has been a number of layoffs, there has been reduced pay, reduced workweeks.

And I think a lot of that success was due to the fact that there weren't as many people that were in the business, and we were kind of pioneers and far ahead; whereas, today there's many more people that are willing to say this is a business to get in, and the way to do it is to stay on the coattails of the innovator and just copy chips.

And so we have run into the problem of serious copying from domestic and international competitors who have targeted this industry and will get their way into the market on our innovation.

And in particular, the problem that I know of with our industry in this recession has been the fact that the people who have copied our innovative chips have been able to drive the prices down dramatically, and we have lost market share, and it has made it very difficult for us.

Mr. KASTENMEIER. How sanguine are you with respect to the efficacy of this legislation in terms of what might be called international piracy, granted that the industry this country is supporting is and appears to be obviously the differences between outright piracy and replication, and reverse engineering is noted?

In other words, is there a sort of an ethical agreement in this country with what is appropriate and what is not? How effective might this be abroad? I guess we are talking about Japan, Taiwan, or the Soviet Union or other countries?

What impact do you think this will have? Will it solve the problem?

Mr. DUNLAP. I believe it will solve the problem because if you foreclose a huge market, and the U.S. market is still about 70 percent of the worldwide market, it will effectively discourage them. There may be a few people who will make it for their own internal use, and of course that would not be significant enough for us to be concerned about.

The other thing that it does—and I have talked to a number of international firms who are aware of this bill, and the majority of them do support it. In fact, the issue of reverse engineering, clarifying that in the Senate bill, was brought up by NEC, a Japanese corporation, and we worked out language that was acceptable and basically they do support the bill.

So that even though it technically would only cover the United States, practically these people understand it, and they support it, and I think it will have the effect of discouraging copying worldwide.

Mr. KASTENMEIER. I have some other questions, but I am going to defer to the gentleman from Michigan.

Mr. SAWYER. I have no further questions.

Mr. DUNLAP. But you understand it better now?

Mr. SAWYER. I understand it.

Mr. KASTENMEIER. The gentleman from Massachusetts.

Mr. FRANK. My question, some of which you have answered—and I don't want to duplicate—you say that everything up to it being imprinted on the chip is now copyrighted?

Mr. DUNLAP. Yes; at one time or another the Copyright Office has accepted it.

Mr. FRANK. And the fact that they have copyrighted—or the majority opinion is that it is not——

Mr. DUNLAP. It does not extend to the pattern on the chip, and the argument is that it is a utilitarian object. We are not asking to protect a utilitarian object.

Mr. FRANK. But what they are saying is that we have the question, was the booksellers—the memory is on the chip—if that is the software memory, that is protected?

Mr. DUNLAP. Yes.

Mr. FRANK. But the analogy apparently has been held—but then you can't hold that other things transferred to the chip are——

Mr. DUNLAP. In 1980 there was an amendment to the copyright law that specifically protected software.

Mr. FRANK. And because the others were excluded that doesn't cover them?

Mr. DUNLAP. Yes.

Mr. FRANK. Let me then ask. Yes, go ahead.

Mr. STERN. There is a specific passage in history to the 1976 act which reaffirms the validity of the line of cases which say that the copyright in a drawing does not extend to protect the physical object depicted in the drawing, and that is the obstacle to economic production.

Mr. FRANK. I don't want to get into that because I don't know about it.

The only other question I have is your reaction to the publishers position that—not that they object to any specific protection that you are asking for, but that we should be very careful to make sure that they don't have precedential effect or any—do you think that is possible, a reasonable concern?

Mr. DUNLAP. Certainly it is possible. I think you have taken care in the drafting that that will not be the case, and certainly it is clear in their testimony on the bill.

We have made amendments to the Senate bill to take care of these specific problems that they have. For example, there was language in the bill which said that the purchaser of the chip could be sued. We have taken that language out which is unique to copyright law. The reader cannot be sued. And we are willing to change and make similar amendments here.

The reverse engineering one was always part of the statements of Mr. Edwards, but it was not specifically part of the bill. It is not part of this bill, but we have added language to the Senate bill. I guess as far as a new statute is concerned, we could write such a statute to properly protect semiconductors. The problem with that is really one of timing.

Mr. FRANK. We do not need to get into that. My own sense would be that the statute could be very explicit, some of the points we have talked about both in the report and in the legislative history and in a couple of cases that you have addressed. We need not go into that. I just do not think it is sensible type of drafting.

Thank you, Mr. Chairman.

Mr. KASTENMEIER. The gentleman from Ohio, Mr. Kindness.

Mr. KINDNESS. Thank you, Mr. Chairman.

Is there any reason why read-only memory on a microprocessor semiconductor chip should be protected by copyright protection?

Mr. DUNLAP. Not the read-only memory, the bits that are put into the memory would be protected as the software. The pattern of the 1's and 0's are protected as software whether they're on paper or whether they're on magnetic media or on silicon. That's basically the state of the law now.

In the case of the ROM itself, there is what's called a cell, which is basically a mechanism that remembers whether it's a 1 or 0, and the specific layout of that cell, the picture of how that cell looks would be protected by copyright.

Mr. KINDNESS. How would it be protected by copyright?

Mr. DUNLAP. Under copyright by this bill, the picture of the cell would be protected.

Mr. KINDNESS. Is there any reason why read-only memory should be protected by copyright?

Mr. DUNLAP. Yes; because the design of the cell is the same as the design of a random logic circuit. It's still the specific picture of the cell, which should be protected. If someone else wants to try out their own cell, reverse engineer the cell, they should be allowed to do that.

Mr. KINDNESS. Is there a degree of uniqueness to that part of a semiconductor chip that it is really a part of the problem here? Or is it the random access part——

Mr. DUNLAP. Well, the memory is slightly different from the random logic. See, the ROM part can be protected today under copyright. Whereas the random logic cannot be protected.

The difference is cells from a picture standpoint, are going to look more like each other, but still there will be a big difference from the standpoint of did you really copy it or not. It will be clear whether it was copied or not, it will be clear that you copied it if you do not have this trail of documents.

So I guess the point about the memory is that you have more of these gray areas which we talked about earlier.

Mr. KINDNESS. Thank you.

Mr. KASTENMEIER. I just have one question. Do you support H.R. 1028 in its current form without any modification?

Mr. DUNLAP. Yes; we support the bill exactly as it is, although there have been some amendments suggested by other people which we would also support.

Mr. SAWYER. I have one question, if I might.

Mr. KASTENMEIER. The gentleman from Michigan.

Mr. SAWYER. I am still in the rudimentary stages. Is my understanding correct that a chip and a map or drawing or mask or whatever is superimposed on the chip, does it in effect take the place and perform the same function of printed circuitry?

Mr. DUNLAP. Yes; it does. It's just that you can put more functions in silicon than you could on a printed circuit board. It just takes up more space.

You take the first computers, which would fill up this entire room with just a connection of vacuum tubes, and now the same functions are performed by that chip which I showed you.

Mr. SAWYER. That is all. Thank you.

Mr. KASTENMEIER. There has been some discussion, as represented by Mr. Baumgarten and others, as to whether copyright law per se is appropriate or whether some other form of legislation, design legislation, might cover this area, since you are not any longer asking for a 75-year term. Do you have any feelings about that particularly?

Mr. DUNLAP. Yes; I have two feelings on that. The No. 1 feeling is that I believe that the thing that we're trying to do is very close to the historical notion of copyright law. In other words, we're trying to say when you project the image on the silicon, when you take the image off the silicon, that's also a copy. And when you project a copy, when you project it back, that's a copy.

So in my mind, it's very close to the basic principle of copyright. It's just that we have new technology which is, No. 1. No. 2 is that in early 1984 there is going to be a number of 256K RAM's coming on the market, a number of new microprocessor chips coming on the market for the first time. Part of the reason that we are lagging some of the international competitors in certain markets is that they were able to copy some of our innovative designs, and we would like to make sure that in early 1984, when these designs come out, that they will not be copied and we will be in the same position that we are in now.

Mr. KASTENMEIER. One last question that I have. For those of us on this committee—and I think we will probably include everybody—we are not very knowledgeable on the issue. And to the extent that you now have fully educated us here today, do you have any popular references that you might recommend? For example, this National Geographic article appeared in October of 1982. Do you recommend that?

Mr. DUNLAP. I think that is probably the best article for understanding.

Mr. KASTENMEIER. I guess that is your answer then.

Thank you very much. You have been very helpful, not only to explain your industry position but also to educate the committee on what is and is not happening technologically. We thank you and your colleagues for appearing.

That concludes this morning's hearing. There will be another day of hearings, the date and place of which will be shortly announced. Until that time, we stand adjourned.

[Whereupon, at 11:58 a.m. the hearing was adjourned.]

COPYRIGHT PROTECTION FOR SEMI-CONDUCTOR CHIPS

THURSDAY, DECEMBER 1, 1983

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON COURTS, CIVIL LIBERTIES
AND THE ADMINISTRATION OF JUSTICE,
COMMITTEE ON THE JUDICIARY,
Washington, D.C.

The subcommittee met, pursuant to call, at 10:15 a.m., in room 2226, Rayburn House Office Building, Hon. Robert W. Kastenmeier (chairman of the subcommittee) presiding.

Present: Representatives Kastenmeier, Schroeder, Glickman, Berman, and Sawyer.

Staff present: Michael J. Remington, chief counsel; Deborah Leavy, counsel; Joseph V. Wolfe, associate counsel; and Audrey Marcus, clerk.

Mr. KASTENMEIER. The subcommittee will come to order.

This morning, without objection, the hearings may be covered in part or in whole by photography or other electronic media. There being no objection, this hearing will be televised by C-Span, and other cameras will be allowed also.

Since this is a concluding hearing on the subject of protection for semiconductor chips, I thought I might suggest again how small this object really is. I have in my hand a semiconductor chip. It is smaller than most stamps. I could blow it away more easily than I could extinguish birthday candles. It is less durable than many insects or plants.

Yet, it is this item that has introduced us to a new age: the information age. At its simplest, the microchip is electronic circuitry. At its most complex, it can hold 1 million electronic components. The chip not only can store information, but it possesses the ability—much like the human mind—to embody memory and logic.

Stated simply, the hearing this morning is on this chip—the creative work that goes into it, and the legal protection that should be accorded it.

Without question, the semiconductor chip is at the center of the information society. The chip has placed us at the threshold of an unprecedented communications revolution. It is estimated that scientific and technical information increases 13 percent every year; this means that the resource of information doubles every 5 or 6 years. The United States is close to having an economy based on a key resource that is not only renewable but self-generating.

The computer age deals with conceptual space connected by electronics, rather than physical space connected by the automobile. The maps of today may truly be the microscopic grids found embedded in a semiconductor chip.

This morning the subcommittee is holding a concluding day of hearings on copyright protection for semiconductor chips. The bill before us, H.R. 1028, adds "mask works" to the list of works that can be copyrighted.

Partially as a result of the first day of hearings and partially as a result of written statements submitted to the subcommittee, at least two major issues have surfaced. The first issue relates to whether the protection for mask works should be pegged to the principles of traditional copyright law or whether a hybrid protection should be tailored. The second issue relates to the constitutional and policy implications of retroactivity.

The record should reflect that these issues, in my opinion, are serious enough for me to have written letters to a number of respected scholars and lawyers around the country soliciting comments on the issues. Responses will be reprinted in the hearing record under the heading "Additional Statements." I ask unanimous consent to insert a copy of the text of my letter in the hearing record.

[The Kastenmeier letter follows:]

U.S. HOUSE OF REPRESENTATIVES,
COMMITTEE OF THE JUDICIARY,
Washington, D.C., October 24, 1983.

Prof. JOHN A. KIDWELL,
School of Law,
University of Wisconsin, Madison, Wis.

DEAR PROFESSOR KIDWELL: You are most probably aware that the House of Representatives is giving serious consideration to enactment of a bill (H.R. 1028, introduced by Mr. Edwards and Mr. Mineta; copy enclosed) to extend copyright protection to "mask works" embodied in semiconductor chip products.

I am writing to you and several other professors of copyright law to elicit the views of disinterested copyright experts on whether you favor some form of statutory protection for mask works and semiconductor chip products; whether the basic approach of H.R. 1028 is sound; and whether protection should be applied retroactively. The Subcommittee on Courts, Civil Liberties, and the Administration of Justice would welcome any written comments you would care to submit for inclusion in the hearing record. (A hearing was held on August 3, 1983, and another will be held in the near future.)

H.R. 1028 now provides that the act would take effect ninety days after enactment, but would not apply to chip products or masks manufactured in the United Stated or imported into the United States before the effective date. However, arguably the bill would protect mask works created and distributed before the effective date, with respect to their embodiment in particular chip products or masks after the effective date. In addition, the subcommittee is aware of a draft proposal in the Senate that makes more explicit the retroactive nature of mask work protection. The Senate draft proposal distinguishes between acts of infringement and subject matter protection. There would be no liability for otherwise in infringing acts, if the acts occurred before the effective date. However, mask works embodied in chip products commercially distributed in the United States on or after January 1, 1980 would be "grandfathered" into the Act in terms of subject matter protection. Liability would arise for acts of infringement occurring after the effective date.

The Subcommittee would welcome comments about the appropriateness, if any, of retroactive protection for mask works, and about the need, if any, for clauses to safeguard persons detrimentally affected by the change in the Copyright Act. You may want to address the question from both a constitutional and policy perspective.

Secondly, the general approach of H.R. 1028 is to fit protection for mask works within the principles of traditional copyright law (Chapters 1 through 8 of Title 17 of the U.S. Code), with adjustments for the scope and term of protection, special provision for innocent infringers, and a compulsory license. At the August 3, 1983 hearing (and also in Senate hearings), technical objections were made regarding the proposed "use right," the impact of the bill on the term "copies" and on fair use, the scope of permissible reverse engineering, and the clarity of the distinction between the "mask work" copyright and copyright in other works embodied in chip products (e.g., literary works and computer programs).

A specifically tailored design law has been advanced as an alternative approach to protect designs of semiconductor chips. It has been suggested that the long-pending design bill (see, e.g., H.R. 2985, also enclosed) could be modified to apply solely to design of semiconductor chip products. The basic features of a design approach could be similar to H.R. 1208, especially with respect to term, exclusive rights (eliminating the "use right"), and innocent infringers. The design law could be added as a separate, stand-alone Chapter 9 to Title 17 of the U.S. Code.

Your comments about the advantages and disadvantages of a copyright law or design approach, about retroactivity, and any other points you care to address would be most helpful to the subcommittee in finding the most appropriate statutory mechanism to afford protection for the semiconductor chip industry against piracy. Your comments should be received by December 1, 1983, to assure full consideration.

Sincerely yours,

ROBERT W. KASTENMEIER,
Chairman, Subcommittee on Courts, Civil Liberties and the Administration of Justice.

Enclosures: H.R. 1028, H.R. 2985.

Mr. KASTENMEIER. I am pleased to note that the witnesses who will appear this morning have, at least in part, addressed these issues. We are fortunate to have three extremely well informed witnesses, a professor from Emory University Law School and two individuals who have testified before us in the past, the Commissioner of Patents and also a senior official in the Copyright Office.

First, I would like to call as a witness, Prof. Ray Patterson, Emory University Law School. Professor Patterson has previously served as dean of the Emory Law School. He has studied copyright law for well over two decades, perhaps 25 years, and indeed has authored a book entitled "Copyright in Historical Perspective." We are pleased, Professor Patterson, to hear your perspective, historical or otherwise, on the important issues confronting this committee this morning.

You may proceed.

TESTIMONY OF L. RAY PATTERSON, PROFESSOR OF LAW, EMORY UNIVERSITY SCHOOL OF LAW

Mr. PATTERSON. Thank you, Mr. Chairman.

Mr. Chairman, members of the subcommittee, my name is Ray Patterson. I am a professor of law at Emory University School of Law. Having been a student of copyright law and its historical development for some 25 years, I very much appreciate the opportunity to appear before the subcommittee and to express some ideas resulting from my studies.

Mr. Chairman, with your permission, I would like to submit my written remarks for the record and merely summarize them at the present time.

Mr. KASTENMEIER. Without objection, your statement will be received for the record and you may proceed as you wish.

Mr. PATTERSON. Thank you, sir.

I wish to view the problem of copyright protection for semiconductor chips in the context of copyright and new technology and view the problem from a conceptual standpoint. There are two reasons for examining the concept of copyright in the light of new problems that technology poses.

First of all, copyright law as it presently exists does not have a sound conceptual basis.

Second, unless there is an agreement on a sound conceptual basis, the problem of copyright and new technology will continue to be resolved on an ad hoc basis in all probability with consequences that Congress neither contemplated nor intended.

The conclusions that I have come to are these:

First, it would be unwise for Congress to provide copyright protection for semiconductor chips by amendment to the present statute. The basis for this conclusion is that the present copyright statute purports to provide for an author's copyright.

Second, the appropriate solution to the problem of protection for semiconductor chips is the creation of what I call an industrial copyright separate and distinct from the author's copyright. The basis for this conclusion is that the copyright protection for semiconductor chips under the present statute would be to create another fiction for copyright and contribute to the conceptual confusion that has plagued copyrights for over two and one-half centuries.

Anglo-American copyright, of course, was the product of technology. But the interesting point here is that copyright existed for some 300 years before it was applied to any product of any new technology, and Congress traditionally has provided copyright protection for the products of new technology with considerable reluctance.

The relevant question is this: Why has Congress been reluctant to grant copyright protection to new technology?

The answer to this question, in my opinion, is the lack of a sound conceptual base for copyright law. If the fundamental principles are agreed upon, there is common ground for agreeing on what to do and no way of predicting what rules will emerge by way of judicial interpretation of ambiguous legislation.

Now, the fault here has not been that of Congress, but history, which has resulted in a copyright that can be characterized as a schizophrenic legal concept.

The copyright clause empowers Congress to secure to authors the exclusive right to their writings for limited times. One would assume from this language that copyright is intended to benefit authors, but the Supreme Court says this is not so. Copyright is intended primarily to benefit the public. And yet, the copyright statute functions primarily to benefit the publishers or the entrepreneur.

The contradiction in constitutional language, court decisions, and congressional actions has an explanation in the tortuous history of copyright development as a result of which we have a major conceptual weakness in copyright law. That weakness is a dicotomy between form and function. In form, copyright is an author's right. In function, it is a publisher's right.

The point here is simply that the concept of copyright does not have a sound theoretical basis because it encompasses two contradictory and antithetical ideas. That is, that it is a statutory monopoly of one's own creations. Despite its label as an author's right, copyright is functionally a concept of statutorily unfair competition based on the misappropriation rationale. It serves the entrepreneur better than the author.

The point is demonstrated by the work made for-hire doctrine and the fact that the current statute confers benefits on the copyright owner rather than the author. Indeed, there is only one provision in the 1976 Copyright Act that is of unique benefit to the author, and that, of course, is the termination right.

To provide copyright protection for semiconductor chips by amending the present statute will be to widen the gap between the form and the function of copyright. More important, perhaps, Congress is not here dealing only with semiconductor chips, it is dealing with the problem of copyright for the products of new technology of which the semiconductor chip is only the beginning.

The semiconductor chip bill is the pilot project and it is important to understand the essential difference between copyright protection for a book and a semiconductor chip. A book is a product and end in itself. A semiconductor chip is both a product and a process, a means to an end. Copyright protection for the semiconductor chip in traditional terms can be analogized to a copyright for books that protect the printing press as well as the book.

My objection is not legal protection for semiconductor chips. My objection is protection for them in terms of author's copyright, and what I suggest is the creation of an industrial copyright designed for and directed to the problems that need to be resolved. The essential problem to which the industrial copyright would be directed is industrial piracy. One of its major advantages is that it would provide an opportunity to create new remedies which are not necessarily appropriate for the author's copyright.

Moreover, I think such a statute would provide an opportunity for considering the public interest, since the fair use doctrine, the major protection for the public interest in the present statute, has little meaning when applied to semiconductor chips.

My argument for an industrial copyright is twofold. First, it would provide more effective protection for industry because it would be based on an unadulterated predicate. Statutory unfair competition based upon the misappropriation rationale. A sound and generally accepted predicate would be protection against judicial misinterpretation resulting in a free choice of competing principles, a particular decision that the confused concept of copyright presently provides.

Second, such a statute would be a major step toward establishing a sound conceptual basis for the traditional author's copyright. It would provide a basis for cleansing the copyright law of provisions dealing with problems of no consequence to the creative author, but which serve to dilute his protection.

I have always thought, for example, that the failure to give recognition to the moral right of the author is one of the major deficiencies of our copyright law, and the failure to provide better protection for the author I attribute to the confused concept of copyright. The conceptual basis for an author's copyright should be protection for the reputation as well as the profit of the author, predicated on the fact that creative works are an expression of the author's perpetuity.

The conceptual basis for an industrial copyright should be purely and simply unfair competition based on the misappropriation rationale.

The ultimate point perhaps is that copyright law must encompass and balance the interests of three groups, the creator, the entrepreneur, and the public. With increasingly sophisticated new technology, the balancing process is becoming increasingly complex and difficult. That is why I contend that we must turn to fundamentals and establish a sound conceptual base for copyright law.

To amend the present statute to provide protection for semiconductor chips would be to create an additional obstacle to the many that already stand in the way of needed reform.

Mr. Chairman, that concludes my formal remarks. I would be happy to attempt to answer any questions the members of the subcommittee may have.

[The statement of Mr. Patterson follows:]

Prepared Statement of L. Ray Patterson, Professor of Law, Emory University School of Law

Mr. Chairman and members of the subcommittee: Having been a student of copyright law and its historical development for some 25 years, I appreciate this opportunity to appear before the subcommittee to express some ideas resulting from my studies.

One of the advantages of not representing any particular constituent is the opportunity to view a problem in terms of general rather than particular issues. I wish to take advantage of the opportunity and view the problem of copyright protection for semiconductor chips in the context of copyright and new technology. Consequently, my approach is a conceptual one.

There are two reasons for examining the concept of copyright in light of the problems that new technology poses: First, copyright law as it presently exists does not have a sound conceptual basis. Secondly, until and unless there is agreement on a sound conceptual basis, the problem of the application of copyright to new technology will continue to be resolved on an ad hoc basis, in all probability with consequences that Congress neither contemplated nor intended.

The ultimate issue is the problem of integrity in the law of copyright. By integrity, I mean consistency in the principles which the law encompasses. While consistency for its own sake is a virtue of small consequence, consistent principles for a body of law are essential for integrity in the interpretation and administration of that law.

The conclusions to which I have come are two: (1) It would be unwise for Congress to provide copyright protection for semiconductor chips by amendment to the present statute. The basis for this conclusion is that the present copyright statute purports to provide for an author's copyright. (2) The appropriate solution to the problem of protection for semiconductor chips is the creation of an industrial copyright, separate and distinct from the author's copyright. The basis for this conclusion is that copyright protection for semiconductor chips under the present statute would be to create another fiction for copyright and contribute to the conceptual confusion that has plagued copyright law for over two and a half centuries.

The route to reach these conclusions is a circuitous one, with many by-ways which there is no time to explore here. But a good starting point is to recognize that Anglo-American copyright in origin was the product of new technology, the printing press, which William Caxton introduced into England in the 1470's. The interesting point is that copyright existed for 300 years before it was applied to the product of other technology, the camera in 1865.

The 1865 act notwithstanding, Congress traditionally has granted copyright protection for the products of new technology with considerable reluctance. It was not, for example, until 1972 that Congress provided copyright protection for sound recordings. And even in the current statute, copyright for phonorecords is the most limited of the copyrights available under the act in that copyright for sound recordings precludes duplication, not imitation.

The relevant question here is this: Why has Congress been reluctant to grant copyright protection to new technology? The answer, I think, is the lack of a sound conceptual basis for copyright law. If the fundamental principles are not agreed upon, there is no common ground for agreeing what to do, and no way of predicting what rules will emerge by way of judicial interpretation of ambiguous legislation. The most recent example is the *Apple Computer* case in which the Third Circuit gave an expansive reading to section 102(a) of the Copyright Act and in effect gave a judicial answer to the legislative question with which this subcommittee is now concerned. *Apple Computer, Inc.* v. *Franklin Computer Corporation,* 219 U.S.P.Q. 113 (3d Cir. 1983).

The fault here is not that of Congress, but history, as a result of which copyright can be characterized as a schizophrenic legal concept. The copyright clause empowers Congress to secure to authors the exclusive right to their writings for limited times. One would assume from this language that copyright is intended to benefit authors. But the Supreme Court says this is not so. Copyright is intended primarily to benefit the public. Yet the copyright statute functions primarily to benefit the publisher or entrepreneur. The contradiction in constitutional language, court decisions, and congressional action has an explanation in the tortuous story of copyright development, which is reflected in the major conceptual weakness of current copyright law. That weakness is a dichotomy between form and function: in form copyright is an author's right, in function it is a publisher's right.

This dichotomy has created and continues to support the basic controversy over the concept of copyright: Is it a regulatory or a proprietary concept? The Supreme Court has answered the question. Copyright is a regulatory, not a proprietary concept, a statutory monopoly granted in the interest of the public. Yet, the answer has never been wholly accepted because of the characterization of copyright as an author's right. It is one thing to say that copyright for a publisher is a statutory monopoly, quite another to say that copyright for an author is a statutory monopoly. A person's writings are uniquely his own, for as an ancient Irish king is supposed to have said in resolving a copyright dispute: "To every cow her calf."

The point here is simply that the concept of copyright does not have a sound conceptual base because it encompasses two contradictory and antithetical ideas: a statutory monopoly of one's own creations. Thus, despite the insistence of the Supreme Court that copyright is a regulatory concept, the notion that it is in fact a proprietary concept persists, and it is this view of copyright that underlies the *Apple Computer* opinion. And it is this view that has been the basis for continually enlarging the statutory monopoly of copyright, on occasion unwittingly so.

One example will suffice to illustrate my point. In the 1790 Copyright Act, the exclusive rights given to the copyright owner were to print, reprint, publish, and vend the copyrighted works, books, maps, and charts. Until the 1909 act, these remained the exclusive rights for literary works. In the 1870 Copyright Act, Congress provided copyright protection for, among other things, statuary and models of works of fine art. The exclusive right given in connection with these works was the right to copy. In the 1909 Copyright Act, the exclusive rights given to all copyright works were the rights to print, reprint, publish, copy and vend all copyrighted works.

House Report 2222 indicates that Congress was not cognizant of the implications of the change. But it is one thing to give the copyright owner the exclusive rights to print, reprint, publish and vend a book. It is quite another to give him in addition the exclusive right to copy the book. And except for the notion that copyright is an author's right, there would have been no reason for the change. The consequences of the change, of course, were not felt until the advent of new technology in the form of the Xerox, and paradoxically this change in the 1909 act presented Congress with one of its most difficult problems in enacting the 1976 Copyright Act.

Despite its label as an author's right copyright is functionally a concept of statutory unfair competition based on the misappropriation rational that serves the entrepreneur better than the author, a point demonstrated by the work-made-for-hire doctrine and the conferring of statutory benefits on the copyright owner rather than the author. Indeed, there is only one provision of the 1976 Copyright Act that is of unique benefit to the author, the termination right, the origin of which can be traced back to the Statute of Anne of 1710, the English copyright act which served as the model for the American Copyright Act of 1790. And there are few who would argue that the work-made-for-hire doctrine is of benefit to the author.

To provide copyright protection for semiconductor chips by amending the present statute will be to widen the gap between the form and the function of copyright. To say that copyright for semiconductor chips is an author's copyright is to stretch fiction beyond both its rational and functional limits. More important, perhaps, Congress is not here dealing only with semiconductor chips, it is dealing with the problem of copyright for the products of new technology, of which the semiconductor chip is only the beginning.

The semiconductor chip bill, then, is only the pilot project and it is important to understand the essential difference between copyright protection for a book and a semiconductor chip. A book is a product, an end in itself. A semiconductor chip is both a product and a process, a means to an end. Copyright protection for the semiconductor chip in traditional terms can be analogized to a copyright for books that protects the printing press as well as the book.

My objection is not legal protection for semiconductor chips. My objection is protection for them in terms of an author's copyright. What I am suggesting is the creation of an industrial copyright designed for, and directed to, the problems that need to be resolved. To deal with these problems, an industrial copyright would have the characteristics of both copyright and patent, and would in effect be a quasi-patent right.

The essential problem to which the industrial copyright would be directed is industrial piracy. One of its major advantages would be that it would provide an opportunity to provide new remedies not appropriate for the author's copyright. An industrial copyright statute, for example, could create an action in the nature of the common law qui tam action authorizing an action on behalf of the copyright owner by the United States Attorneys, with half of any recovery going to the United States. Precedent for the qui tam type action is found in the Copyright Act of 1790, which was based on the pure qui tam action in the Statute of Anne. Moreover, such a statute would provide an opportunity for considering the public interest, since the fair use doctrine, the major protection for the public interest in the present statute, has little meaning when applied to semiconductor chips.

My argument for an industrial copyright statute is twofold: First, it would provide more effective protection for industry because it would rest on an unadulterated predicate: statutory unfair competition based on the misappropriation rationale. A sound and generally accepted predicate would be protection against judicial misinterpretation resulting from a free choice of competing principles to govern a particular decision that the confused concept of copyright presently provides.

Secondly, such a statute would be a major step toward establishing a sound conceptual basis for the traditional author's copyright. It would provide a basis for cleansing the copyright law of provisions dealing with problems of no consequence to the creative author, but which serve to dilute his protection. I have always thought, for example, that the failure to give recognition to the moral right of the author is one of the major deficiencies of our copyright law. Authors and artists in a very real sense are the persons who teach us to appreciate beauty in which we find the values that give quality to life by creating the conscience which impels us to strive for justice and equality. They merit protection for their efforts, and the failure to provide better protection I attribute to the confused concept of copyright.

The conceptual basis for an author's copyright should be protection for the reputation as well as the profit of the author, predicated on the fact that creative works are an expression of the author's personality. The conceptual basis for an industrial copyright should be purely and simply unfair competition based upon the misappropriation rationale.

To round out the scheme, there should be an additional type of copyright, one to protect the entrepreneur who enables the author to secure his profit, that is the publisher, or one who produces works that have no one author, e.g. television broadcasts, the exemplar of which is the work made for hire. This could be characterized as a commercial copyright.

The ultimate point, perhaps, is that copyright law must encompass and balance the interest of three groups: the creator, the entrepreneur, and the public. With increasingly sophisticated new technology, the balancing process is becoming increasingly complex and difficult. That is why we must return to fundamentals and establish a sound conceptual base for copyright law. To amend the present statute to provide protection for semiconductor chips would be to create an additional obstacle to the many that already stand in the way of needed reform.

Mr. KASTENMEIER. Thank you for that very provocative and enlightening commentary.

As I understand it, you are suggesting that we should return to, more or less, the original, fundamental concept of copyright. At least we should not further erode the original concept of copyright, reflecting the necessity of protecting the author's work and writings. You see that as distinguished from an industrial type of work that should be protected; but we should not presume that it is copyright in the traditional sense or that copyright ought to be used to protect that right. Is that analysis correct?

Mr. PATTERSON. Yes, sir, that is correct.

Mr. KASTENMEIER. There are other formulations and suggestions. For example, it has been submitted that we have a design protection, and that the protection should be perhaps for 10 years. What would your comment be about these suggestions as contrasted with the conceptual industrial copyright that you speak of?

Mr. PATTERSON. Mr. Chairman, I think that the design approach is an attempt to do in a sense what I am suggesting, but I think it does not do it in a direct way, in the way that you could deal with the problem if, say, we are dealing here with an industrial copyright and not simply design protection. To say that you are dealing with design protection I think is to engage in further fiction and to further create confusion, certainly on a conceptual basis.

My point here is that a semiconductor chip, for example, needs legal protection, but the protection that it needs is protection against misappropriation by competitors. I think it is entirely appropriate that the term of such a copyright should be limited to say 10 years, but when you start talking about the design protection, you get into this problem of protection for design for useful articles which heretofore Congress has rejected and which the courts have rejected because of the monopoly problem.

I think by viewing this as an industrial copyright, we can recognize directly that we do have a monopoly problem and we want to deal with that problem directly.

Mr. KASTENMEIER. One of the problems I have at this point in history, assuming that there is a need to do something in that area and assuming that we started with the approach that you suggest, is we would have to start at zero. That is to say, we would have to redesign or define for the first time what is industrial copyright, who shall administer such a new right, and the general parameters of it. This might cause a very considerable delay in rethinking the whole matter through. Assuming there is some urgency about this, what would your comments be in that connection?

Mr. PATTERSON. My first thought is of the *Apple Computer* case. My impression—and I must confess I haven't had time to analyze the *Apple Computer* case as thoroughly as I would like—but my impression there is that that case does essentially what the proposed copyright bill is to do under the present copyright statute. Now, I assume that case will go up to the Supreme Court and what the Supreme Court will do, of course, I don't know, but if that decision stands, I think that the semiconductor industry has protection under the third circuit opinion in the *Apple Computer* case.

Mr. KASTENMEIER. From your perspective and our perspective, that may still suggest a sense of urgency. If indeed we agree with you that it should not be copyright protection, we are nonetheless confronted with a sense of urgency. And a decision may be necessary that runs counter to what you have said here this morning?

Mr. PATTERSON. Well, if I may make one observation here, Mr. Chairman, I think the *Apple Computer* case is an excellent example of the problem I have been talking about, that is, the confused concept of copyright, because the *Apple Computer* case was decided under the present statute and it is the result of a very expansive reading of section 102(a). So, unless Congress steps back and deals with the problem more directly, I see a further expansion of the copyright monopoly through judicial decisions which Congress neither intended nor contemplated when it passed the copyright bill.

Mr. KASTENMEIER. Yes; to simplify, the lead paragraph in the New York Times of September 2 reported as follows:

In an important victory for major computer and software manufacturers a federal court of appeals has ruled that all computer programs can be copyrighted, even if they are an integrated part of the computer circuitry.

Mr. PATTERSON. Yes, sir.

Mr. KASTENMEIER. That would tend to expand the impact of that to obviously the area that we are considering here?

Mr. PATTERSON. Yes, sir, and I do not think Congress contemplated that problem when it passed the present copyright statute.

Mr. KASTENMEIER. I would certainly agree with that and——

Mr. PATTERSON. This is why I contend, even at the cost of some delay, that Congress should give serious consideration to the creation of the industrial copyright, and I must say, Mr. Chairman, I do not think it would be as difficult to draft that legislation as may first appear, because I think the principles are all in history and we can simply go back to history.

Mr. KASTENMEIER. Thank you very much, Mr. Patterson.

I would like to yield to my colleague, Mr. Sawyer.

Mr. Sawyer.

Mr. SAWYER. Thank you, Mr. Chairman.

What would be the practical difference between an industrial copyright as you visualize it and the proposed amendment to the copyright law including these chips? What would it do differently?

Mr. PATTERSON. It would be a more limited monopoly than the copyright monopoly that we have under the current statute.

Mr. SAWYER. In what way?

Mr. PATTERSON. Well, for example, the current statute says that the term of the copyright shall be the life of the author plus 50 years, or in the case of a work made for hire, 75 years from the date of publication or 100 years from the date of creation.

Mr. SAWYER. So, let's say we reduce it to 10 years. What are the other differences?

Mr. PATTERSON. The major difference I think would be that you would recognize that the industrial copyright is not the product of an author. It would be analogous to the work made for hire under the present copyright statute.

Now, I think that you can get better protection for industry with what I would characterize as an industrial copyright than you can get by amending the present Copyright Act, because as I have said earlier, I think that creates further confusion.

Mr. SAWYER. Let's say we change the term to 10 years. What else as a practical matter, would it do differently?

Mr. PATTERSON. I am sorry, sir, I don't know exactly what you mean by that.

Mr. SAWYER. What different attributes would it carry. What different protection would it carry. Why would it be different, assuming we made the term of years different?

Mr. PATTERSON. Well, one practical difference I see is that under the current statute you have a doctrine of fair use. You have five rights, exclusive rights of copyright proprietor. The application of those five exclusive rights is not necessarily appropriate for a semiconductor chip, as I see it.

I think that the major practical difference is that the courts are going to give varying interpretations of the statute relative to semiconductor chips because of the ambiguity in the concept of copyright. I think that one thing that could be done, for example, would be to design more appropriate remedies under an industrial copyright statute that are not appropriate for traditional copyright.

Mr. SAWYER. Such as what?

Mr. PATTERSON. Well, I think that there is a good basis for arguing that you could have a qui tam-type remedy for an industrial copyright statute. That goes back to the early English copyright statutes which did contain a qui tam remedy and the 1790 American Act, which contained a similar qui tam-type remedy. Now, the problem as I see it here——

Mr. KASTENMEIER. You might, for the benefit of the committee and others, explain what qui tam——

Mr. PATTERSON. This in common law was an action whereby a private individual was authorized to bring an action and share the recovery with the Government, even though that individual was not directly affected by the wrong which had occurred as a result of the statute.

Now, I say a qui tam-type remedy in this sense: It seems to me that the major problem we are dealing with here is industrial piracy, and I see no reason why an industrial copyright statute could not provide that the United States, by a U.S. attorney, would be authorized to bring actions on behalf of private individuals whose industrial copyright had been infringed, with the result that half of the recovery would go to the U.S. Treasury.

Mr. SAWYER. Why would we want to do that and (*a*), why would we want the United States to come in to protect a private property right; and (*b*), why would we want to give part of the recovery to the United States?

Mr. PATTERSON. Well, to answer the second part of your question first, the answer there is to benefit the United States.

Mr. SAWYER. Deficits?

Mr. PATTERSON. Yes, sir, to encourage U.S. attorneys to do this sort of action.

Mr. SAWYER. If some individual is harmed, obviously the United States doesn't have to come in and protect him. I am sure he would be interested in protecting himself, as it would be his interest that would be involved.

Mr. PATTERSON. Well, that I think, sir, is the question. I am assuming that we do have a major problem in which there is a large public interest. You know, I am not really putting forth this idea as something that should be done, but I think it is an example of a new approach to a problem which could be considered.

Mr. SAWYER. Well, I have some sympathy with the idea that we are trying to stretch copyright law that was originally designed to protect printed media in all its terms into covering electronic

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media and covering things like chips and designs. I really think we seriously ought to back up.

I don't know as I am in agreement with some of the specifics of what you are suggesting, but I wonder whether we shouldn't back up and tailor some totally different statutes leaving the existing one for the printed media which it was designed for, instead of starting to spring it into covering everything else. Why not start anew and create one for the electronic mess that we are in between the satellites, and cable, and broadcasters, and producers, and what not. We could create a new one that does not try to adapt print media law to that problem, and perhaps on designs and chips, go to something that amounted to a kind of unfair-competition-type copyright statute, if you will. I am sympathetic with the idea and I have been fretting with that since I have been involved with this.

Thank you. I yield back my time.

Mr. KASTENMEIER. The gentlewoman from Colorado.

Mrs. SCHROEDER. Thank you, Mr. Chairman.

I guess I want to go a little further and see if I can figure out the constitutional validity of what we are talking about here. Do you think a mask work would be considered a writing?

Mr. PATTERSON. For constitutional purposes I think that the courts would uphold the constitutionality of House bill 1028. I say that on the basis of history, on the basis of what the courts have done in the past, and I cannot see any real basis for the courts striking down this particular bill on constitutional grounds.

Mrs. SCHROEDER. So, in other words, you are not arguing on a constitutional basis that we shouldn't proceed in this manner?

Mr. PATTERSON. No, ma'am.

Mrs. SCHROEDER. You are doing it more on a utilitarian basis?

Mr. PATTERSON. Utilitarian basis and, frankly, an interest in what I would characterize as the integrity of the copyright law. Now, I realize the consistency for its own sake has very little merit. I think it is very important here to have consistent principles for the purpose of administering and interpreting the statute.

Mrs. SCHROEDER. Who would you have administer an industrial copyright?

Mr. PATTERSON. I think the Copyright Office.

Mrs. SCHROEDER. You would have the same group?

Mr. PATTERSON. Yes; the Copyright Office could do that.

Mrs. SCHROEDER. And the remedies you said could be different, and I heard you say the 10 years. The United States would share part of it, maybe. Are there other remedies that you are for that haven't been articulated?

Mr. PATTERSON. I frankly have not given that much thought to it, Mrs. Schroeder. I am confident that it would be appropriate to provide other remedies, and don't let me give you the impression I am suggesting a qui tam remedy or qui tam-type remedy. I am merely suggesting that is the type of thing that could be considered.

Mrs. SCHROEDER. One of my problems is that if you think that proceeding down this way is constitutional, and you would still do the industrial copyright but have it administered in the same office, then we would not run a risk that you would spend years in the courts trying to decide which were more like industrial and which were more like author-type copyrights, and if you had different types of remedies, obviously it would be very, very useful to try to get things under the 10-year provision rather than the author provision.

Wouldn't we create a new can of worms?

Mr. PATTERSON. Yes; I can see that problem and I think the answer to that problem is going to be in how the legislation is drafted.

Mrs. SCHROEDER. I am not sure any of us have Solomon's wisdom. That is how we got here to begin with.

Mr. PATTERSON. I can agree, and I contend that if we go back to fundamentals, that it is possible to do this and to make it clear to the courts that the principles upon which the industrial copyright is based and the principles upon which the author's copyright is based are different.

Mrs. SCHROEDER. Do you think we in the Congress could do that? Give us an insurance policy and we won't mess it up more. We may be writing an attorney's relief bill.

Mr. PATTERSON. I have great faith in Congress, and let me say that I think the 1976 Copyright Act is basically a very good act and the persons I fault in that are not Members of Congress, or the copyright bar. The persons I fault are the scholars and writers, the people who are supposed to develop these ideas and present them to Congress, I think legal educators have been very remiss in this area. That is where the real fault lies.

Mrs. SCHROEDER. Thank you.

Thank you very much.

Mr. KASTENMEIER. The gentleman from Kansas, Mr. Glickman.

Mr. GLICKMAN. No questions.

Mr. KASTENMEIER. Mr. Berman.

Mr. BERMAN. I am confused by which you view as this public protection notion and the author protection notion as contradictory, particularly as applied in this situation. Why couldn't it be viewed that by protecting the author or designer or creator that there is a derivative long-term benefit to the public and that there is nothing inconsistent with those two notions. The benefit obviously being that more people are encouraged to use their creativity if they can reap some financial rewards from it?

Mr. PATTERSON. If I understand your question, Congressman Berman, why do I say we have a problem conceptually in terms of copyright? That really goes back to history. I think that when you are talking about drafting legislation or interpreting legislation, that the fundamental principle on which you are operating is very important.

In the case of the copyright law, there have been two contradictory principles. One is that copyright is to protect the interest of the author. The other is that copyright is to protect the interest of the publisher.

Mr. BERMAN. Publisher, not the public?

Mr. PATTERSON. Publisher, yes, the entrepreneur, and this again is because copyright originally was a publisher right.

Mr. BERMAN. I thought you said it was to protect the public.

Mr. PATTERSON. No; publisher.

Mr. BERMAN. Forget the question. Another question—you make the distinction somewhere that it is one thing to give the copyright owner the exclusive right to print, reprint, publish, and vend a book. It is quite another to give him in addition the exclusive right to copy the book.

Mr. PATTERSON. Yes, sir.

Mr. BERMAN. Why is it quite another thing?

Mr. PATTERSON. Well again, let me go back to history, Congressman Berman. The original copyright statute, the 1790 act, gave the copyright owner the exclusive right to print, reprint, publish, and vend the work. Now, until the 1909 act, those were the only exclusive rights in conjunction with literary works.

The effect of that was to say that one who copied the work for the purpose of printing and selling it, infringes the copyright, but when Congress in 1909 added the exclusive right to copy, those limitations were no longer present. That is, the exclusive right to print and publish a work is not quite as broad as the exclusive right to copy a work, because as an individual, I might very well copy the work, but I am not going to print it or publish it or vend it.

So in that sense, Congress enlarged the scope of the copyright monopoly, and my own personal view is that Congress was not aware of the implications of the change, and I think this is indicated by House Report 2222 on the 1909 Copyright Act. What Congress did was simply take the exclusive right to copy, which had been added in the 1870 act in connection with statuary and designs of fine art, and made it applicable to all copyright works without realizing the implications of that change.

Of course, the change did not become significant until the advent of Xerox, whereby an individual could copy an entire book without any great difficulty. This I think created one of the problems that Congress had difficulty with in the 1976 act.

Now, I argue here that if you had not been viewing copyright as an author's right, or if Congress had not been viewing copyright as an author's right, there was no real justification for the addition of the exclusive right to copy. This is simply an example of what I think is a result of a confused concept of copyrights.

Mr. BERMAN. Thank you.

Mr. SAWYER. Well, if we went to design protection or something called design protection, would there be any implications, do you think, from a precedent standpoint for other areas that seek similar protection, such as typeface and industrial designs and all the others?

Mr. PATTERSON. Yes, I do; I think there would be that implication. I think this would be opening the door.

As I said, the semiconductor bill, I think, is merely a pilot project. That is why it is so important and so significant that Congress be absolutely sure of what is being done here.

Mr. KASTENMEIER. But in any event, as relates to term of protection, there would be very little justification for conferring terms such as life plus 50 or 75 years in such a fast-moving technology.

Mr. PATTERSON. Yes; I fully agree with that. That is one of the reasons for going to what I would contend should be the industrial copyright.

Mr. KASTENMEIER. Well, in conclusion, I must say I think I agree with your essential analysis. It is directed in part to this committee and myself. I participated obviously in the period 1965 to 1976 when we wrote the copyright law, and I think, from your own analysis, we tended to make the copyright law a huge tent to cover all proprietary conflicts which it was really not, as you point out, equipped to cover.

Even though we had, I think, marvelous people advising us, very often they inadvertently degraded the copyright law in the sense that you describe it.

Mr. PATTERSON. Yes.

Mr. KASTENMEIER. I say inadvertently, because I think what they had in mind was enlarging it to cover other areas; in making the law more pervasive they sensed more importance in copyright, when perhaps that should not have been our purpose at all.

Mr. PATTERSON. Yes.

Mr. KASTENMEIER. We should have found other means to resolve some of these things. As you point out, it may be too late now to reconcile the contradictions. Now we cover NFL football games, as though they were a writer's creation. They are not.

Mr. PATTERSON. Yes.

Mr. KASTENMEIER. And a great deal of other material which I think makes a mockery of what copyright was intended, certainly originally, as far as its concept, to cover.

In any event, we are indebted to you, Professor Patterson, for your appearance this morning. We may again call upon you for some help.

Mr. PATTERSON. Thank you, Mr. Chairman.

Mr. KASTENMEIER. I would now like to call a very distinguished witness. Indeed, we consider him a friend of the committee, a person who has been a witness before this committee many times. He is the Assistant Secretary of Commerce and the Commissioner of Patents and Trademarks. He also chairs the Working Group on Intellectual Property, Cabinet Council of Commerce and Trade, of the White House, he is one of the most thoughtful people in or out of Government, not only on this issue, but many, many others obviously in his own field.

So I am very pleased to greet Mr. Secretary, Gerald Mossinghoff.

TESTIMONY OF GERALD J. MOSSINGHOFF, ASSISTANT SECRETARY OF COMMERCE AND COMMISSIONER OF PATENTS AND TRADEMARKS; CHAIRMAN, WORKING GROUP ON INTELLECTUAL PROPERTY, CABINET COUNCIL ON COMMERCE AND TRADE, THE WHITE HOUSE

Mr. MOSSINGHOFF. Thank you very much.

Mr. KASTENMEIER. You may proceed as you wish. I see you have a short statement.

Mr. MOSSINGHOFF. The first two pages of my statement generally summarize the economic case that can be made and what the situation is. So if we could put my formal statement in the record, I will begin at the bottom of page 2 and summarize the actions of the Cabinet Council and the position of the administration on the bill.

Mr. KASTENMEIER. Without objection, your statement will be received.

Mr. MOSSINGHOFF. Mr. Chairman, the administration very much welcomes these hearings on this very important subject.

There are no effective legal means of stopping the copying of semiconductor chips under existing U.S. laws. Patent protection is available for the process of making the chip, for the electronic circuit embodied in the chip, or for the chip itself as an article of manufacture, provided that the process or the circuit or the article of manufacture meets the patentability requirements of being new, useful, and unobvious.

While a patent on the circuit would protect against the manufacture, use, or sale of the circuit, the circuits in chips are usually well known and, therefore, unpatentable. Patents for the process of making the chip or for the chip itself as an article of manufacture would not ordinarily protect against a taking of the design.

Copyright protection is currently not available for chip designs, principally because the design of the chip is considered utilitarian in nature. The Copyright Office presently refuses to register claims to copyright in the design of semiconductor chips or in the chips themselves.

Trade secret protection is available but only up to the time that the first disclosure or unrestricted sale of the chip is made.

Legislation to protect semiconductor chip designs has been introduced in each of the three previous Congresses. Several approaches have been suggested to provide the additional protection that is needed.

Of these, I believe that the copyright approach is the preferable method for protecting semiconductor chip designs. This approach has several advantages.

The system could take advantage of the well-established procedures and remedies of the copyright law. It would provide prompt, inexpensive protection through a registration system without substantive examination.

In addition, the United States is a party to the Universal Copyright Convention. If the United States protects semiconductor chip designs by copyright, it would be much easier to persuade other members of the UCC to follow the lead of the United States and establish comparable and compatible protection for semiconductor chip designs. Despite a minority view that the copyright law should be reserved for artistic rather than utilitarian creations, the copyright approach is preferable, in my view.

The Cabinet Council on Commerce and Trade has established a working group on Intellectual Property to consider the increasing number of important issues in this field. This working group, which I chair, considered H.R. 1028 and its companion bill, S. 1201. On September 14, 1983, the Cabinet Council, on the recommendation of Secretary Baldrige, unanimously endorsed legislation to protect semiconductor chip designs with the following specific characteristics:

It should provide prompt, inexpensive protection for original semiconductor chip designs through a registration system without substantive examination.

It should grant to the owner of the chip design the exclusive right to copy, for commercial purposes, the chip design, or chip embodied in that design, as well as the exclusive right to distribute such a chip.

The exclusive right should exist for a relatively short term, for example, 10 years.

The legislation should provide an express right of reverse engineering for the purpose of teaching, analyzing or evaluating the concepts or techniques embodied in the design of the semiconductor chip.

Finally, unless there are overriding circumstances to the contrary, the protection should be prospective from the current timeframe.

Thus, the administration strongly supports legislation along the lines of H.R. 1028—amended to include the reverse engineering provision. Such a measure would fill the gap in intellectual property protection which currently exists for an important segment of our economy and would enhance the incentive to create new technology.

Mr. Chairman, that concludes my prepared statement. I would be pleased to answer any questions you or the other members of the subcommittee may have.

[The statement of Mr. Mossinghoff follows:]

PREPARED STATEMENT OF GERALD J. MOSSINGHOFF, ASSISTANT SECRETARY OF COMMERCE AND COMMISSIONER OF PATENTS AND TRADEMARKS

Mr. Chairman and members of the subcommittee: I welcome this opportunity to testify on the "Semiconductor Chip Protection Act of 1983", H.R. 1028. This bill would amend Title 17 of the United States Code to protect semiconductor chips and masks against unauthorized duplication.

The bill would make available to the semiconductor industry the established procedures and remedies of the copyright law by adding "mask works" as a new category of copyrightable works. It would provide to the owner of the copyright 10 years of exclusive rights to make or distribute the masks, to make chips from the masks or reproduce the mask onto a layer of a chip, and to use or distribute such chips. Innocent good faith purchasers of such chips would be protected and, if they had made a substantial investment, could acquire a compulsory license at a reasonable royalty for continued or future use of the chips.

The semiconductor industry is a vital and rapidly growing part of the U.S. economy. The Bureau of Industrial Economics of the Department of Commerce forecasts that in 1983 the industry will ship more than $12.6 billion worth of semiconductor and related devices. This amount is sharply up from the estimate for 1982 of $10.9 billion.

U.S. companies still dominate the field, accounting for 67 percent of the worldwide semiconductor market. It is projected that in 10 years semiconductors will have sales exceeding $90 billion and will be the basis for two of the four major industries of the 1990's—computers and telecommunications.

The intricate patterns or designs of semiconductor chips can be copied and used to produce duplicate chips at the fraction of the large initial research and development costs necessary to create a functioning chip. As the level of complexity of the circuits has grown, so has the cost of creating chip designs embodying those circuits. The research and development costs of a single complex chip is estimated to cost approximately $4 million. Such a chip could be copied photographically for as little as $100,000. A relatively simple chip would cost approximately $425,000 for research and development, and this chip could be duplicated and placed on the market in 3 to 6 months with an investment of $30,000 to $50,000, or approximately one-tenth of the investment of the chip originator.

The net effect of chip copying is to shorten the period during which research and development costs can be recovered. This can only discourage companies from making the large investments necessary for advancing this technology. Instead, it encourages them to engage in chip copying to the detriment of worldwide technological advancement in this important field.

There are no effective legal means of stopping the copying of chips under existing United States laws. Patent protection is available for the process of making the chip, for the electronic circuit embodied in the chip, or for the chip itself as an article of manufacture, provided that the process or the circuit or the article of manufacture meets the patentability requirements of being new, useful and unobvious. While a patent on the circuit would protect against the manufacture, use or sale of the circuit, the circuits in chips are usually well-known and therefore unpatentable. Patents for the process of making the chip or for the chip itself as an article of manufacture would not ordinarily protect against a taking of the design.

Copyright protection is currently not available for chip designs, principally because the design of the chip is considered utilitarian in nature. The Copyright Office presently refuses to register claims to copyright in the design of semiconductor chips or in the chips themselves.

Trade secret protection is available but only up to the time that the first disclosure or unrestricted sale of the chip is made.

Legislation to protect semiconductor chip designs has been introduced in each of the three previous Congresses. Several approaches have been suggested to provide the additional protection that is needed. Of these, I believe that the copyright approach is the preferable method for protecting semiconductor chip designs. This approach has several advantages. The system could take advantage of the well-established procedures and remedies of the copyright law. It would provide prompt, inexpensive protection through a registration system without substantive examination. In addition, the United States is a party to the Universal Copyright Convention (UCC). If the United States protects semiconductor chip designs by copyright, it would be much easier to persuade other members of the UCC to follow the lead of the United States and establish comparable and compatible protection for semiconductor chip designs. Despite a minority view that the copyright law should be reserved for artistic rather than utilitarian creations, the copyright approach is preferable, in my view.

The Cabinet Council on Commerce and Trade has established a Working Group on Intellectual Property to consider the increasing number of important issues in this field. This Working Group, which I chair, considered H.R. 1028 and its companion bill, S. 1201. On September 14, 1983, the Cabinet Council, on the recommendation of Secretary Baldrige, unanimously endorsed legislation to protect semiconductor chip designs, with the following specific characteristics:

It should provide prompt, inexpensive protection for original semiconductor chip designs through a registration system without substantive examination.

It should grant to the owner of the chip design the exclusive right to copy, for commercial purposes, the chip design, or chip embodied in that design, as well as the exclusive right to distribute such a chip.

The exclusive right should exist for a relatively short term, e.g., 10 years;

The legislation should provide an express right of reverse engineering for the purpose of teaching, analyzing or evaluating the concepts or techniques embodied in the design of the semiconductor chip.

Finally, unless there are overriding circumstances to the contrary, the protection should be prospective from the current timeframe.

In testimony before the Senate Subcommittee on Patents, Copyrights, and Trademarks, at the May 19 hearing, several witnesses mentioned the desirability of an exception for "reverse engineering". The Senate subcommittee staff circulated proposed amendments in the form of a draft subcommittee print that would provide an option for an express right of reverse engineering for the purpose of teaching, analyzing or evaluating the concepts or techniques embodied in the design of the semiconductor chip. The Senate Subcommittee reported out a bill last month which contains such a reverse engineering provision.

This reverse engineering exception essentially incorporates a desirable feature of the copyright law. Making a limited number of copies for teaching purposes generally constitutes "fair use" under the copyright law.

Thus, the administration strongly supports legislation along the lines of H.R. 1028 (amended to include the "reverse engineering" provision). Such a measure would fill the gap in intellectual property protection which currently exists for an important segment of our economy and would enhance the incentive to create new technology.

Mr. Chairman, that concludes my prepared statement. I would be pleased to answer any questions you or the other members of the subcommittee may have.

Mr. KASTENMEIER. That certainly was concise, but to the point.

Is there any bill or prototype of a bill which might not have yet been introduced which embodies the recommendations of the Council, other than the provisions as you cite them one by one?

Mr. MOSSINGHOFF. No, Mr. Chairman. We took this matter to the Cabinet Council in sort of a broad conceptual framework and the decision that they made is as outlined in my statement. The bill itself, H.R. 1028, would satisfy these criteria that the Cabinet Council unanimously recommended.

That is not to say other pieces of legislation might not also satisfy those.

Mr. KASTENMEIER. How about retroactivity? Do you think the law ought to be retroactive?

Mr. MOSSINGHOFF. That would be an area that we think you should examine very carefully. The basis for that decision of the Cabinet Council was two strongly held views. One of the views was that it is a very appropriate thing for the Federal Government to do, to stimulate private investment in the creation of new wealth in the form of net technology.

A second view was that it is not an appropriate function of the Federal Government to be in the business in this area of distributing wealth. And the second principle is what led the Cabinet Council to its view that the protection should be in general prospective from the current timeframe.

That is kind of loosely worded and, indeed, was loosely worded in the minutes of the Cabinet Council. We would, of course, defer to the committee.

But it would seem to me personally that the current timeframe could well be the time when Congress began serious consideration of this, so you don't have, in effect, a rush to copy in order to come in under some threshold that is determined by the actual date of enactment.

So that is the reason for the less than crisp statement.

Mr. KASTENMEIER. The matter has been approached with some urgency, but other commentators suggest, as you observe in your statement, that American companies dominate the semiconductor market worldwide and currently account for 67 percent of the world market and all these things have taken place under the existing legal framework. What is the great urgency about moving into legislation when industry has fared so well notwithstanding the lack of protection?

Mr. MOSSINGHOFF. I think a couple of factors enter into this, Mr. Chairman. One is the fact that these chips are becoming increasingly expensive to sell. For example, there are two cases that I know of—there may be more—but there is a case of *Zilog* v. *The Nippon Electric Co.* that I think is still pending before the International Trade Commission. The chip in that case sold somewhere between, say, $2 and $7 million. A second case, *Intersil* v. *Teledyne,* the chip in that case would sell for $5 or $6 million. However, as these chips become increasingly complex, the economic payoff of the copying becomes increasingly attractive to those who would copy.

Second, I think the chips themselves in a commercial form only entered the marketplace in the early- to mid-seventies. They are now becoming ubiquitous. There is not a thing you can buy these days that doesn't somehow have a chip in it.

In addition to that, the technology to copy the chips is becoming well understood. So we think we are in a period of exponential growth of chips—that is, exponential growth in the return one could reap if one were to copy the chips.

Finally, it seems to me this is probably the best time to act when there are—I don't want this remark to be misunderstood—not a lot of vested interests on the other side.

If there were to be a body of vested interest of copiers, you would have a much more difficult time, I think, legislating what is generally agreed, and I believe just about unanimously agreed, to be a very appropriate kind of protection for this new technology.

Mr. KASTENMEIER. That is about what happened 4 years ago or so. We looked at this question. I think you are quite right to say it has been around awhile. We found that we were not talking about foreign corporations, but there were as many domestic computer corporations that used or reverse engineered chips in contrast to the creation of new chips. These corporations were able to have a sort of industrial deadlock on the question that apparently has been resolved; but a conflict certainly did exist at one point in time.

Mr. MOSSINGHOFF. I am aware of no significant opposition to the concept that these chips are deserving of some form of protection against copying.

Mr. KASTENMEIER. You are speaking from the perspective of the Patent Office, and you are not claiming this area, for whatever reasons, for the Patent Office. You are willing to let some other agency handle this one.

Mr. MOSSINGHOFF. We have enough paper in the Patent Office to deal with, Mr. Chairman.

Mr. KASTENMEIER. Between the concept of whether this is copyright, industrial copyright, or covered by what might be termed design protection, similar to Congressman Moorhead's bill.

Mr. MOSSINGHOFF. As I indicated, this was not an issue, again. We did not bring that specific issue to the Cabinet Council for a resolution. I think it really is something that the experts—this subcommittee is the expert subcommittee on the copyright law—can decide.

So we purposely—and Secretary Baldrige agreed, we would bring the broad concepts to the Cabinet Council and then work as closely as we could to work out the details. I think the copyright protection has some advantages that the subcommittee should clearly consider.

First, I am not an expert in copyright law, but I don't think copyright was intended even from the Founding Fathers' point of view simply to cover artistic things. I believe that in the 1790 act they specifically provided for the copyright of nautical charts.

Mathematical tables are copyrighted, they are very valuable. Anyone can produce them themselves, but they have to go through the labor or use calculators to produce them. City directories are copyrighted. A book of nautical charts, for example, clearly is a utilitarian device more than something of an artistic creation.

Second, the member on the working group from the State Department took a very strong position—and he has years of experience in the international copyright business—he took a strong position that if we were to create some separate form of protection in the United States, the possibility of convincing other nations to create the same kind of protection would be a lot less than if we simply expanded our copyright law specifically to cover this new area, and then would work through the State Department and through the Copyright Office and other places to perhaps convince other nations, other industrialized nations, to emulate our form of protection. He saw this as a lot easier thing to do if we worked through the Universal Copyright Convention.

Finally, the *Apple* v. *Franklin* case, the Third Circuit Court of Appeals decision cited by Professor Patterson, I think is a classically good and sound analysis on how a utilitarian copyright on a computer program could be infringed if the copyright is fixed in the form of a semiconductor chip.

That case, in my opinion, dispels the doubts on whether or not it would be appropriate to go one step further and say the actual masks used to make the chips could be a form of copyrightable subject matter.

Mr. KASTENMEIER. If *Apple* v. *Franklin* prevails or is sustained, is there any need for legislation?

Mr. MOSSINGHOFF. Very definitely.

Mr. KASTENMEIER. Wouldn't the court have spoken, and we have only but to translate into legislation that which the court has said?

Mr. MOSSINGHOFF. No; the *Apple* v. *Franklin* decision held that where someone had a copyright on a computer program, following all the procedures of the Copyright Office and getting a copyright, say, on a written program that comes in either in source code or whatever, that that copyright on the paper computer program could indeed be infringed if the program were adopted or copied into a semiconductor chip.

This computer program could be put on a semiconductor chip in an infinite number of ways. The mask work to put a given program onto a chip could be varied by the author of the mask work. It depends on the author of the mask work who makes the chip as to how to put the program on the chip.

What we are talking about here is the actual work going into the fabrication and making of the chip itself. The *Apple* case is relevant but certainly not dispositive. It is relevant because the court said, that putting a copyrighted computer program—and I think most people agree computer programs are virtually purely utilitarian and not artistic—into a chip is a fixation for purposes of determining infringement.

So you need to go that next step and say that if the chip does not include a computer program the *Apple* v. *Franklin* case would not protect it.

Mr. KASTENMEIER. I would like to yield now to my colleague from Michigan.

Mr. SAWYER. Is the only reason for trying to fit all these things within the existing copyright law is because it would be easier to get international emulation?

Mr. MOSSINGHOFF. I would not say it is the only reason. I think it is a good reason.

Another reason would be that there is a body of law built up in the copyright area, the procedures are all well known. As a Government employee of many years, I don't like bureaucracies and new bureaucratic regulations.

It seems to us that is a good reason, that you would use existing procedures, concepts, handling, and all the rest. I think that that is another good reason.

Let me be clear. The Cabinet Council itself took no position on this. If we could get a bill enacted which adopts in some form those criteria of the Cabinet Council, we would clearly support that legislation.

Mr. SAWYER. Would we be advantaged if we created a copyright, if you will, for a silicon chip pattern—would we be advantaged by picking up all the baggage and the freight of the years and years of decisions that have gone into protecting authors of printed media, or would we be better rid of that baggage by starting with a different concept that in effect, would protect the right to the design on a silicon chip?

Mr. MOSSINGHOFF. That is obviously a consideration that would have to be made. I would say that you do have in the scheme of protecting intellectual property the approaches bounded by the patent system on the one side and the copyright system on the other.

In the patent system, we demand that an objective novelty and obviousness—objective novelty and obviousness criteria—be satisfied. We don't care whether the inventor knew or didn't know about work done that resides in some international library in Europe.

If we know about that reference, we won't issue a patent to the inventor. Similarly, if someone gets a patent, whether the infringer knows or doesn't know about the patent, if the infringer wanders into the boundaries of the patent, that infringer infringes.

Copyright is on the other side. It is a subjective form of protection where we require only subjective originality on the part of the author, and we require copying on the part of the infringer.

So if someone independently were to come up with the same thing, say, a city directory, it is not an infringement. This clearly, I think, falls into the subjective area of legal concepts.

It clearly is that kind of technology where it is served by the subjective type. And if you didn't accept the copyright concepts—and I am not purporting to be an expert in copyright law—there would be a long time before you would build up a new body of law as to what is or is not an infringement in the copyright area.

But it is again a consideration that has to be carefully weighed.

Mr. SAWYER. What bothers me is whether we can analogize the development of a pattern or a mask for a chip with that of a historic author, composer, whatever, of a copyrighted work. I just wonder if we are not disadvantaged by carrying forward court decisions that were predicated on those problems as opposed to something like the mask for a chip.

Mr. MOSSINGHOFF. I understand your position. It is not something that I think you can demonstrate either way. There is obviously a balancing that needs to be done.

I would analogize the chips and the mask to nautical charts. I think that is a good one, nautical charts. You and I could go out and make the same exact nautical chart.

It would cost us a lot of money to go out and take soundings and to hire skilled draftsmen to draw the chart. We could come up with exactly the same nautical chart.

That, as I say, was specifically included in the 1790 Copyright Act. So, clearly, that was considered to be a writing.

I think the mask can very clearly be analogized to that kind of a work of an author.

Mr. SAWYER. Also, once in awhile I think I understand and sometimes I think I don't, the concept of reverse engineering as opposed to copying. Can you quickly explain the difference?

Mr. MOSSINGHOFF. I would say in this case that reverse engineering would be, as I think was explained to the subcommittee—these things are put together like the old Dagwood Bumstead sandwiches. Reverse engineering would be to unpeel the chip, to understand what techniques were used by the person who fabricated it, how did he avoid short circuits between one layer of semiconductor and one layer of conductor, how did they assure the proper resistance between two things.

That would be reverse engineering. You could use exactly the same camera to take a picture, blow the picture up and find out what level No. 1 looked like, do the same as you unpeel this. If you do that merely to understand the concepts of fabrication and the techniques used, I would regard that as reverse engineering.

If you did that in order to go back again and blow your pictures back down to actually fabricate chips, I would call that a copying, if you are going to use, sell, and duplicate it.

Mr. SAWYER. I was impressed with some testimony we had, if my recollection is good, that some of these masks, or circuitry imposed on a chip might cost up in the tens of millions of dollars to develop, and can then be reproduced on a copy basis for, say, $100,000.

Mr. MOSSINGHOFF. I think the data that I have seen would indicate that it is maybe as high as 100-to-1 ratio. Whatever it costs to make it, you can divide by 100 and decide that that is your cost to copy it.

Mr. SAWYER. And there have been chips where they have made a mistake on a mask, and, in effect, cut off a circuit, separated it off, because it was either superfluous or causing a problem, and then chips have come on the market that duplicated the whole thing including the error.

So it is very clear that they are being copied.

Mr. MOSSINGHOFF. Right.

Mr. SAWYER. It would seem to me that that kind of thing certainly needs some protection. Certainly at the very least it is unfair competition. I still have that reservation.

I have had this problem. The electronic technology moves very rapidly. I just wonder if it is worth it to try to put them under the copyright law instead of maybe putting them under a broad section of copyright law but creating, in effect, a totally separate statute within it. Another alternative would be a totally separate segment, that is not tied to the historic decisional processes and everything else that was really aimed at a problem quite different.

Mr. MOSSINGHOFF. I understand that. I am not disagreeing with you. I am saying that we, I think, made the balance in our Office and for the reasons I have indicated would come down in favor of the approach adopted in the bill.

But if another approach can be fashioned which would satisfy the criteria of the Cabinet Council, we clearly support that legislation.

Mr. SAWYER. Thank you.

Thank you, Mr. Chairman.

Mr. KASTENMEIER. The gentlewoman from Colorado.

Mrs. SCHROEDER. Thank you, Mr. Chairman.

We thank you for being here.

One of the complaints, if I can use your patent experience, that I hear about patents is people say when you have them so often the cost of going out to prove someone copied it, you would be better to put the money in R&D and move forward, and do something else.

As I look at these semiconductor chips, it looks like it would make the patent problem fairly simple compared to proving someone did copy your chip.

Would it be a good idea to make people put an intentional mistake in them or some such thing in order to register them, so that it would be easier to tell if they were copied?

Mr. MOSSINGHOFF. I am aware of the case Mr. Sawyer mentioned where it was done accidentally, I think, but it clearly provided fingerprints to show that the thing actually was a copy.

That is an interesting concept. I don't think the matter of proof would be that difficult.

In other words, I think maybe you have a very good idea. It is kind of a new idea. I don't think, though, the matter of proof would be that difficult, though, because an expert can look at those various layers of the chip and pretty well tell what they were exactly.

I mean, it is the case of someone accidentally writing "Gone With the Wind," for example. That is very unlikely. I think it is very unlikely in this case that someone with a complex chip would have exactly the same mask.

Mrs. SCHROEDER. Isn't it really costly and time consuming to go through this whole process? One of the problems with chips is they are moving so rapidly. You do generations in a few years.

Mr. MOSSINGHOFF. That is right. I don't think the matter of proof would be that difficult. I think that there are enough experts around that would be qualified to testify in court, and I think the unlikeliness of someone coming up with exactly the same seven layers to produce exactly the same circuit would be such as to strain credibility.

So I don't think it is that big a problem. I recommend to you and the subcommittee that you consider your idea because that is an interesting one.

I think people may be doing that now, as Mr. Sawyer indicated.

Mrs. SCHROEDER. What do you think about the doctrine of first sale, if we put these under copyright? What would happen? Has anybody ever thought that through?

Mr. MOSSINGHOFF. Well, I don't think it is the same kind of thing. If you prevented copying, you, in a way, are affecting the doctrine of first sale. If a person bought a chip—let's say they bought a vacuum cleaner with a chip in it——

Mrs. SCHROEDER. Or they are going to lease it.

Mr. MOSSINGHOFF. I think they would lease the thing the chip is in. If it is a vacuum cleaner with an integrated circuit control, you would want the people to be able to rent vacuum cleaners if that were the case. So I don't think the first sale doctrine applies here.

Let me reflect on that. It is not similar to the situation regarding the phono records where the administration, supports, along with the Copyright Office, the modification of first sale doctrine for phono records. That is a clear case where people are, in effect, ripping off the composer and performers by renting the record. Sometimes they give out blank tape with it. So the obvious implication is you take it home, transfer it from the record to your tape, and use it.

I think that is a case where first sale doctrine really needs to be amended. Here I don't think I would answer that we have the same problem.

But I would like to think about it more.

Mrs. SCHROEDER. I think it could be helpful to the committee, because we have the first sale doctrine, as you know, in front of us. It is worrisome, especially, as I understand, more and more of these things are being leased. What that all means, I am not quite sure.

Thank you very much.

Mr. MOSSINGHOFF. Thank you.

Mr. KASTENMEIER. The gentleman from Kansas.

Mr. GLICKMAN. Thank you.

I have the same trouble as perhaps Mr. Sawyer was talking about. The fact of the matter is we are dealing with a hybrid concept here. It seems to me it is somewhere between a patent and a copyright concept.

We are not quite sure where to put it. We have this kind of gut feeling that it ought to be given some protection. As you point out, as the chips become more complex, the economic payoff to copying becomes more acceptable and the technology of copying is easier, and you talk about the exponential growth of chips.

This is probably an issue that can be discussed in any copyright-related subject. But I guess my problem is that the industry itself is changing in such an exponential and very, very dramatic fashion that we may be interfering with the ordinary course of change by putting a classic copyright on the chip.

I realize the third circuit decision basically gave the OK to copyright software programs and that kind of thing. But I wonder if you might comment on the analogy that programs themselves are like books but the chips are like words.

It may be a different thing to copyright the finished product, like the program itself. But the chips themselves may be, as component parts, not really as likely or suitable to be copyrighted.

Mr. MOSSINGHOFF. Well, let me start off with saying that that is obviously a decision that you are going to have to make. It is going to be made by the subcommittee when they proceed to further consider this.

I think a lot of the discussion of whether or not the chip is copyrightable centers around the old cases that had to do with whether a lamp could be copyrightable or not, and the answer is the artistic part of it can, but the utilitarian part of it cannot.

I don't like that analogy as well as the analogy to nautical charts or nautical maps or mathematical tables, where those are purely utilitarian things. They may have some beauty. Beauty is in the eye of the beholder. They may be beautiful to someone.

But most computer programs are not very beautiful or very artistic. Most nautical charts are not. They simply serve a utilitarian purpose.

These mask works that are used to create it really, I think, are better analogized to those than books or statuary, even though in some ways it is a three-dimensional thing as opposed to a printing.

I would think that the mask and the actual chip itself embodying the mask would fall into the area of these other things I mentioned that are clearly copyrightable and people get valuable property rights on them.

Mr. GLICKMAN. Well, obviously this doesn't fit in with traditional copyright law. Even with your analogies of the maps and the mathematical formulas, you have an area that is evolving with such rapidity that it does not have any permanence. At least, it looks to me that it doesn't have the permanence of the kind of things that were copyrightable under the deviations that you mentioned. before.

I guess what concerns me is that if change is happening so rapidly. After all, 10 years ago a chip was nothing to what it is today. Through the natural phenomenon, the chip has been allowed to change so dramatically. What will happen in the next 10 or 15 years unencumbered versus what will happen if we have a copyright on the situation is the question.

If we give somebody protection in the process, we may dramatically restrict progress and change in the process. Again, I guess that is a question for us to answer.

Mr. MOSSINGHOFF. I could comment, though, Mr. Glickman. I think we have an analogous situation in the counterfeiting area, where copying trademarks and trademark products is a major problem for the United States and, indeed, a worldwide problem as we have testified before in counterfeiting.

I think you could predict if we just leave the area alone what you are going to see is business executives deciding which is more profitable, do they spend the $10 million to develop a new chip to carry out a given function, or do they go out and buy one and spend one one-hundredth of that amount of money.

If that begins to happen, it might be that tomorrow and the next day and the next day the consumer can buy integrated circuit controls a little bit cheaper because you have competition, but it is inevitable in the long run you are going to dry up the creation of this new technology.

Mr. GLICKMAN. OK. But let's see if there are any other remedies under the law. You talk about trade secret protection in your statement.

You say that trade secret protection is available but only up to the time that the first disclosures or unrestricted sale in chips is made. Is there any way that that aspect of the law could be modified without changing the copyright laws?

Mr. MOSSINGHOFF. Well, I suspect that you would end up modifying it so much that you would not want to call it trade secret law anymore. In other words, the whole essence of trade secret——

Mr. GLICKMAN. That is what we are doing with the copyright laws now essentially. We are modifying them so they don't look like the copyright laws anymore.

Mr. MOSSINGHOFF. I think if you take trade secret law and try to amend it to prevent copying even after the thing wasn't secret anymore, you would come down with some sort of hybrid protection, much like the design bill.

There are a lot of ways to write it. But I don't think you would want to call it trade secret law anymore because the whole essence of that is when companies take special precautions not to let it get out. Indeed, one of the requirements in Hornbook Trade Secret Law is the thing be secret.

If it is sold and can be reverse engineered using standard technology, you have violated criteria one of the Trade Secret Hornbook Laws.

Mr. GLICKMAN. OK. I think that is a useful point. We may be ending up at the same point.

Mr. MOSSINGHOFF. I think there seems to be general agreement that the kind of protection should be copyright-like protection. It should be so if two people were to come up accidentally with exactly the same chip, using their own means to do so, one would not copy the other and one would not infringe the others.

In the patent sense, if two people come up with exactly the same invention, we give the patent to the first person and the first person can enjoin the second person. So I think there is almost unanimous agreement that the kind of protection should be registration-type, copyright-like protection rather than patent-like protection.

Mr. GLICKMAN. I think the legislation, or perhaps your statement talks about the exclusive right should exist for 10 years.

Mr. MOSSINGHOFF. We use that as an example. I don't think you can make a case for 9½ or 10½, but surely not the life plus 50 or 75 years, since it is a fast-moving technology.

We agree with the 10.

Mr. GLICKMAN. But it is the recognition that it ought to be a shorter period of time than with literary works.

Mr. MOSSINGHOFF. Very definitely.

Mr. GLICKMAN. Thank you, Mr. Chairman.

Mr. KASTENMEIER. The gentleman from California, Mr. Berman.

Mr. BERMAN. I have no questions, Mr. Chairman.

Mr. KASTENMEIER. I have just one last question.

Do you agree with the preceding witness that in an ideal world what we are really talking about here is the need for statutory unfair competition standard based on a misappropriation rationale.

Professor Patterson repeated that a couple of times.

Mr. MOSSINGHOFF. Yes; I heard that. I think the answer is yes. I think it is unfair competition for someone—or should be, it is not now—but I think it should be unfair competition for someone to be able to spend a fraction of what an originator spent.

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I think there is a public interest here that I would overlay above unfair competition. As I understand the unfair competition law, an element may be trade disparagement or something like that.

That is kind of an A versus B field of law. I think above that there is a constitutional purpose that is served by the current copyright system, by the current patent system, and that is to stimulate people to invest in things which the public has determined, through the public policymakers, to be good things.

And if the patent laws stimulate people to invest their time and effort, creativity, in bringing out new inventions as a matter of public interest, then we give them a limited period of exclusivity.

So, whereas, unfair competition is kind of a view of business person A against business person B, I think here we are dealing in the area of what the Founding Fathers dealt in, a very good Federal function, stimulating the creation of wealth in the form of new writings and technology.

I guess I agree at one level. But I think there is a much higher level that needs to be served, and that is the level of public interest to stimulate business executives and entrepreneurs to invest in the creation of new techniques.

Mr. KASTENMEIER. Thank you, Mr. Mossinghoff, for your appearance this morning. We always benefit from your testimony and advice.

Mr. MOSSINGHOFF. Thank you, Mr. Chairman.

Mr. KASTENMEIER. Our last witness this morning is Ms. Dorothy Schrader, Associate Register of Copyrights for Legal Affairs and General Counsel with the Copyright Office, an important entity within the legislative branch.

She is a familiar face to us in this committee; she has served many years with the Copyright Office and is extremely prominent in the field.

Ms. Schrader, I notice you have a very long statement. Would you care to try to summarize it? I think you also have a summary statement, too. Also, would you introduce your colleagues?

TESTIMONY OF DOROTHY SCHRADER, ESQ., ASSOCIATE REGISTER OF COPYRIGHTS FOR LEGAL AFFAIRS, COPYRIGHT OFFICE, LIBRARY OF CONGRESS, ACCOMPANIED BY RICHARD GLASGOW, ASSISTANT GENERAL COUNSEL; PATRICE LYONS, SENIOR ATTORNEY; MICHAEL KEPLINGER, POLICY PLANNING ADVISER

Ms. SCHRADER. Yes, Mr. Chairman. I have done both. If you could agree, the full statement would appear in the record, and I will speak largely from the summary you have.

Mr. KASTENMEIER. Without objection, your longer statement, together with its appendixes, will be accepted for the record, and you may proceed as you wish.

Ms. SCHRADER. Mr. Chairman, members of the subcommittee, I am Dorothy Schrader, representing the Copyright Office today at this hearing on H.R. 1028. Let me please first introduce my colleagues who are here at the witness table.

On my right, the Assistant General Counsel of the Copyright Office, Richard Glasgow. On my far right, Patrice Lyons, a senior attorney on my staff. On my left, Michael Keplinger, policy planning adviser for the Register.

The Copyright Office does support the principle of protection for original semiconductors and masks, which will generally be referred to as chips, recognizing that the bill would establish a new subject matter category denominated "mask works."

We fully agree some form of protection is just and necessary. We tend to believe it should be basically on copyright-type principles, for example, the principle of originality.

But we are not certain that the Copyright Act of 1976 is the best answer to this need for protection, and we do have major doubts about certain features of the proposed bill.

We think that in several respects the bill represents an improvement over the 1979 attempt which would have protected chips as artistic works. But we have questions that are described in our lengthy statement, and I will mention some of those briefly.

We think that the case is clear that there should be protection and the question is what is the best mode of protection to prevent chip piracy. Should it be traditional copyright, with a few modifications, or a specially tailored law, perhaps based on design copyright principles?

I would like briefly to review the present legal situation, because I think it is important to note that arguments in favor of protection for chips or chip designs under the current act must confront the barriers of at least four fundamental principles of our traditional copyright law.

First, copyright has not protected useful articles, per se. Second, copyright protects the design of a useful article presently only to the extent that artistic features can be identified separately from, and are capable of existing independently of, utilitarian aspects of the article.

Third, copyright in a technical drawing or other representation of a useful article does not protect against unauthorized duplication of the useful article itself, only against duplication of the drawing authorship.

And last, copyright protects only expression, not ideas, plans, or processes.

As it has been noted, technical drawings are subject to protection under the current act. But they do not provide the kind of protection that is believed necessary by the semiconductor industry, since you don't have protection for the finished chip product.

The Copyright Office has been presented with claims to register copyright in printed circuit boards and in semiconductor products, and we have refused to register those claims. We have to date considered that they are useful articles and have no separate artistic aspects.

Computer programs are copyrightable. The Congress amended the Copyright Act in 1980 specifically to add a definition of computer program and otherwise amend the act to provide that programs would be protected.

As it has been noted, programs may be fixed in chips and they may also be used as tools in the designing of chips. The semiconductor industry apparently believes, however, that copyright for a computer program is insufficient to protect their designs, and we do agree with this conclusion in general.

This inadequacy of protection arises either because some chips may not embody programs at the time they are exposed to duplication, or the part of a chip containing the program may not be duplicated, or the owner of the program copyright may not own rights in the design of the chip.

There is some uncertainty also about the scope of protection for designs developed with the assistance of a computer program.

Turning then, briefly, to discuss the features of the present bill, this would create a new subject matter category of copyrightable work called "mask works."

This category is apparently intended to encompass the skills and creativity, if any, employed in the intermediate stages of producing semiconductor chip; that is, between the first technical drawing and the finished chip product.

But it seems clear, I think, to us and to other witnesses that the ultimate objective is to protect the finished chip against unauthorized duplication.

As you know, the major features of this bill are: Limited term of protection, for 10 years, in contrast to the longer term under copyright; new and modified exclusive rights, the traditional rights set out in the Copyright Act would not apply to this new subject matter category—most importantly, a new right to use the mask work; a compulsory license; and an innocent infringer provision.

The Copyright Office, after reviewing the problems with the pending bill, and considering some basic principles of copyright, as I have described them, tends to believe that a design approach to semiconductor protection is preferable to a copyright solution as a matter of intellectual property policy.

We are not saying it would be constitutionally required. We agree with Professor Patterson that, if Congress decides to protect mask works under the Copyright Act, the courts would likely uphold the law.

But as a matter of intellectual property policy, we tend to believe that a separate, specially tailored law would seem preferable. We also think that careful redrafting of the bill could resolve some and perhaps all of the technical problems that we now see.

But a design approach avoids the necessity of confronting them, because you have a separate law. We are also concerned that some of the problems are of a very fundamental character relating to the basic approach of the pending bill and may prove very difficult to resolve.

I will address some of those now. First, the problem of what is a copy. This is a very fundamental question of copyright law, since the reproduction and distribution of copies are the most common rights conferred by copyright statutes.

If there is any ambiguity or question relating to what is meant by the term "copy," you tend to get into very fundamental difficulties. This was seen, for example, when the Supreme Court decided in 1908 in the *White-Smith* v. *Apollo* case (209 U.S. 1) that piano rolls were not copies of the musical compositions contained in them, and then Congress did not overturn that decision in revising the act in 1909, the result was that, for a period of 70 years, phonograph records were not considered copies of musical compositions.

That, of course, has been changed by the current act. But I mention this just to show the fundamental importance of this concept.

The bill provides that the term "copy," as used to the statute, includes chip products with respect to only 9 of the 36 sections in the copyright law where the term is used. The bill would thus create a distinction between those sections of the law in which chips are treated as the equivalent of copies and those in which they are not.

Of crucial significance, we think, is the point that section 101, which contains the definitions of the act, is not included in the nine sections specified.

The consequences of this seem grave. We question whether a mask work can be published under the act, since the term "copies" in the definition of publication does not include chip products. If the object embodying the copyrighted work is not capable of publication, the notice requirements of the act apparently do not apply. We also question whether chip products would constitute copies of computer programs and other works embodied therein because of the bill.

We realize this result is unintended. In the Senate subcommittee version, an effort has been made to address this question, but we believe that there is a fundamental problem concerning the concept of copies and the way in which chip products would be treated under the bill.

As to the subject matter question, we do note that this would be the first time that Congress would protect a useful article under the Copyright Act. We don't think that this is a constitutional problem, per se, but it is a matter of policy.

We do note that the bill attempts to establish a constitutional basis for the semiconductor product in its definition of semiconductor product, but there is no attempt to specify the constitutional basis for the subject matter of protection which is the mask work.

This is perhaps a technical matter that could be addressed, but it does exist in the bill now.

Another point of concern with respect to the pending bill is the use right. For the first time there would be an exclusive right to use a copyrighted work. This is unprecedented in American copyright law, and in any copyright law that we are aware of. It is a right that is found, I believe, in the patent law, but it is alien to copyright law. We would recommend its elimination. The use right has been eliminated in the Senate subcommittee version.

With respect to the question of retroactive protection, the initial impression of the Copyright Office when we testified in the Senate on the companion bill, S. 1201, was that neither H.R. 1028 nor S. 1201 was intended to protect mask works retroactively.

We now realize that because of the drafting of the effective date provision, it would appear that the bill does protect mask works retroactively. There are limitations on the protection with respect to particular material objects embodying the mask works, depending on when the infringement occurred, but the mask work itself would be protected, apparently, irrespective of when it was created or had been initially distributed commercially.

The Copyright Office believes that retroactivity clauses generally should be scrutinized for basic fairness and appropriateness, and their inclusion in a statute almost always requires safeguard clauses and other provisions to avoid unfairness and actual damage to those whose rights or privileges are curtailed by the law.

Unless they are very carefully crafted, retroactivity clauses invite litigation.

The Copyright Office is not persuaded that the semiconductor industry has sustained the burden of showing the necessity for retroactive protection of mask works. To date, our investigation suggests that this is not a constitutional problem, per se, but it is a matter of fairness and policy as to whether protection should be made retroactive to subject matter that was created and commercially distributed years before the law was enacted to protect them.

In view of the problems that we have noted with the pending bill, and our questions concerning protection of useful articles under the Copyright Act, the Copyright Office considered alternative approaches to protection for semiconductors.

In our Senate testimony we mentioned the possibility of misappropriation protection, and we also discussed a possible design approach in general.

Following that testimony, we were asked to prepare a draft bill that might accord protection for chip designs under design principles, and it is included in our statement as appendix C of the statement.

The Copyright Office is not precisely endorsing this particular approach. We were asked to prepare it by a Member of Congress. We think in general it is better to turn to sui generis legislation than to try to craft the Copyright Act to fit semiconductor chips. At the same time we don't entirely abandon the copyright approach.

If it is the wish of Congress, after reviewing the whole matter and considering the appropriate balance to be achieved, that there should be protection under the Copyright Act, the Copyright Office certainly would be pleased to work with the subcommittee in correcting the technical problems with the bill and in fashioning a suitable administration for the protection if the Copyright Office is designated as the administering agency.

Under a design approach, which we tend to prefer, Congress would establish a new form of legal protection specifically for the design of semiconductors. It could be in a separate, independent chapter of title 17 of the United States Code, but separate from chapters 1 through 8, which now represent the Copyright Act.

Protection would be accorded under a standard of originality similar to that of the Copyright Act, but you would not have the whole body of copyright precedent for 150 or 200 years, that would have to be gaged, assessed, and considered in determining whether particular mask works did constitute original works of authorship—the statutory standard for determining whether you have a protectable work under the Copyright Act.

The design approach would directly confront the utilitarian nature of semiconductor chips, and would simply accord protection on the basis of the skill, labor, and investment employed in developing original designs.

The constitutional basis, although unstated, would be the patent-copyright clause of the Constitution, probably more the writing aspect, but perhaps an amalgam of writings and discoveries. The exclusive rights conferred would be: To make, have made or import for sale or use in trade, and to sell or distribute for sale or for use in trade, the chip product embodying the protected design.

Although the terminology is different, we think these are basically similar to the rights proposed for mask works in H.R. 1028—except for the use right.

Protection would also endure for 10 years from the date the design was registered or first made public, whichever occurs first. Protection would be accorded only prospectively under the draft design bill.

The registration system is somewhat simplified, and the certificate of registration would constitute prima facie evidence of the facts stated, but would not be prima facie evidence of the validity of the protected design, per se, as is the case under the Copyright Act, where registration within 5 years of publication means that the certificate is prima facia evidence of validity.

There would be no examination of the prior art under the draft design bill following copyright-like principles, but a defendant in an infringement action could cite the prior art and shift the burden of proof back to the plaintiff.

The remedies are similar to those under the Copyright Act, but no provision has been made for criminal infringement. That could be added, of course, if that were the wish of the subcommittee.

There are penalties for false marking, fraud, and false representation.

Finally, I would mention some of the advantages of a design approach. It establishes an especially tailored scheme of protection solely for the design of a semiconductor chips, avoiding the problems of fitting traditional copyright policies and principles to the previously unprotected useful article. It would avoid the technical, substantive problems that we have discussed, such as the problem of what is a copy and the relationship between the copyright in a computer program fixed on semiconductor chip material and copyright in the mask work.

There would be a specific definition of design of a semiconductor chip product which we think is somewhat clearer than the concepts of mask work and images of a mask work as used in the pending bill.

In conclusion, Mr. Chairman, we fully support the general proposal to protect the innovators of semiconductor chips, but we tend to believe a better system of protection could be achieved under a design approach. Nevertheless, we would be happy to work with you, if you elect to follow a copyright approach. Thank you very much. That ends my formal statement. If you have any questions, I will try to respond.

[The statement of Ms. Schrader follows:]

STATEMENT OF DOROTHY SCHRADER

ASSOCIATE REGISTER OF COPYRIGHTS
FOR LEGAL AFFAIRS
COPYRIGHT OFFICE

Before the Subcommittee on Courts, Civil Liberties
and the Administration of Justice
House Committee on the Judiciary
98th Congress, First Session
December 1, 1983

Mr. Chairman and members of the Subcommittee, I am Dorothy Schrader, Associate Register of Copyrights for Legal Affairs and General Counsel of the Copyright Office. I thank you and the Subcommittee staff for giving me the opportunity to appear before you on H.R. 1028, a bill to protect semiconductor chips and masks against unauthorized duplication. The Copyright Office supports the principle of protection for original semiconductor chips and masks (hereafter generally referred to as "chips"). Some form of protection is just and necessary. The Office is, however, not certain that the Copyright Act is the best answer to this need for protection, and we have doubts in any event about some features of the proposed bill. Other features of the bill do represent an improvement in comparison with the approach considered by Congress in 1979,1/ which I will discuss later.

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1. H.R. 1007, 96th Congress, First Session (1979) would have simply provided that the "photographic masks" and "imprinted patterns" on integrated circuit chips were copyrightable as "pictorial, graphic, and sculptural works."

CONTENTS

I. INTRODUCTION

In introducing H.R. 1028, Mr. Edwards aptly described the importance of semiconductor chip technology to our country; the investment, skill, and effort, required to develop chips; and the ease with which "chip pirates" rip off these products, "undersell the innovator and flood the market with cheap copies of the chip."[2] Senator Mathias in introducing the companion bill, S. 1201, observed that "creative scientists and engineers must be protected from theft and exploitation" and that the "ingenuity of an age that has produced a tool as remarkable as the computer chip should be able to devise laws adequate to protect it."[3]

The Copyright Office fully agrees with these remarks: those who create must be rewarded and protected by our laws. If the Congress accepts this point in principle, it should be possible to fashion a law that will protect the creators and innovators of semiconductor chip products against piracy.

The question then is: what scheme or mode of protection should be devised to protect against chip piracy — traditional copyright with a few modifications, or a new, specially tailored law based on design copyright principles?

The questions which we are raising about the mode of protection and particular features of the bill are offered to assist in the public debate on this major public policy issue. With this purpose in mind, the Copyright Office in this statement first reviews the present law and Office practices, previous consideration of the chip piracy issue, chip techno-

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2. 129 Cong. Rec. Daily H 643 (February 24, 1983).

3. 129 Cong. Rec. Daily at 5992 (May 4, 1983).

logy, and the need for protection. Next, we analyze the major features of H.R. 1028 and a revision of S. 1201 as reported by the Senate Subcommittee on Patents, Copyrights, and Trademarks, discuss some concerns about the bill and the Senate version and discuss the design approach for protecting chips.

II. BACKGROUND

A. Present Legal Situation

Semiconductor chip technology involves several related elements, some of which are presently registrable[4]/ under the Copyright Act,[5]/ but the scope of the protection is inadequate or uncertain.

Arguments in favor of protection for chips or chip design under the current Act must confront the barriers of at least four fundamental principles of traditional copyright law: copyright does not protect useful articles[6]/ *per se*; 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

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4. Registration of a claim to copyright is made by the Copyright Office following examination if the Office determines that the material deposited constitutes copyrightable subject matter and the other legal and formal requirements of the Act are satisfied. 17 U.S.C. 410(a). If registration is refused, action for infringement may nevertheless be instituted pursuant to 17 U.S.C. 411(a), provided the Register of Copyrights is duly served a notice of the action. The Copyright Office has special expertise regarding registrability. What is protectible under the Act, and the scope of protection, are ultimately for the courts to decide.

5. Title 17 of the United States Code, §§101 et seq. (hereafter generally the "Copyright Act" or the "Act").

6. Section 101 of the Act 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."

article; copyright in a drawing or other representation of a useful article does not protect against unauthorized duplication of the useful article; and copyright protects only expression — not ideas, plans, or processes.

Section 102(b) of the Copyright Act of 1976 clearly provides that: "In no case does copyright protection for an original work of authorship extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, or embodied in such work." 17 U.S.C. §102(b) (Supp. IV 1980). See Baker v. Selden, 101 U.S. 99 (1879). Moreover, where there are only a limited number of ways to express an idea, there may be no protection for the particular expression. See Morrissey v. Procter & Gamble Co., 379 F.2d 675, 678 (1st Cir. 1967) (particular form of expression found to come from subject matter).

1. Technical drawings. Schematic diagrams or similar works containing technical data and drawings of electrical circuits which constitute "original works of authorship" [17 U.S.C. 102(a)] are registrable as "pictorial, graphic, or sculptural works." 17 U.S.C. 101. However, under section 113 of the Copyright Act, protection apparently would not extend to the semiconductor chip product portrayed by the drawing or technical data.

Generally, under section 113(b), the extent of protection afforded a technical drawing that portrays a useful article as such is to be construed in accordance with the law in effect on December 31, 1977. The 1976 House Report[7] refers back to the 1961 Report of the Register of Copyrights where it was stated that, on the basis of judicial precedent, "copyright in a pictorial, graphic, or sculptural work, portraying a useful

7. H.R. Rep. No. 94-1476, 94th Cong., 2d Sess. 105 (1976) (hereafter, the 1976 House Report.

article as such, does not extend to the manufacture of the useful article itself," and recommended specifically that "the distinctions drawn in this area by existing court decisions" not be altered by the statute. The House Report also noted the discussion of this subject in the Register's 1965 Supplementary Report.[8] The 1965 Supplementary Report contains, in a note, a list of court decisions illustrating what is meant by a work portraying a useful article as such.[9]

Technical drawings, prepared as part of the intermediary stages of chip manufacture, are sometimes alleged to be embodied in mylar sheets, photolithographic masks, and related products. The Copyright Office is not aware of any court decision specifically upholding the validity of copyright in such "technical drawings." Sometimes registration has been made on the basis of the "drawing" authorship and the technical data conveyed. As one moves from traditional blueprint-type drawings to mylar sheets and

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8. Supplementary Report of the Register of Copyrights on the General Revision of the U.S. Copyright Law: 1965 Revision Bill, Copyright Law Revision Part 6, 47–48 (1965).

9. Id. at 48. The following cases are of particular relevance: Muller v. Triborough Bridge Authority, 43 F. Supp. 298, 300 (S.D.N.Y. 1942) (court found that "plaintiff's copyright of a drawing, showing a novel bridge approach to unsnarl traffic congestion, does not prevent any one from using and applying the system of traffic separation therein set forth"); Jack Adelman, Inc. v. Sonners & Gordon, Inc., 112 F. Supp. 187, 190 (S.D.N.Y. 1934) ("To give an author or designer 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 unsurp the functions of letters-patent"); and Fulmer v. United States, 103 F. Supp. 1021 (Ct. Cl. 1952) (case involved copyrighted design showing a top view and a side view of a parachute with irregular curved lines painted or dyed upon the cloth of the parachute. The court concluded that plaintiff's petition did not state a cause of action for infringement of copyright).

masks, questions arise about registrability because of uncertainty as to whether the sheets and masks convey information, or are simply part of the manufacturing process.

2. Chips and imprinted patterns therein. The Copyright Office historically has refused, and presently does refuse, to register claims to copyright in the design or layout of printed circuit boards, the design or "topology" of, or imprinted patterns in, semiconductor chips, and the printed circuit boards and chips themselves.[10] The topology of a micro-electronic circuit or other device formed in semiconductor material is arguably an intrinsically useful part of a useful article. The patterns formed in and on semiconductor material, usually a silicon wafer, are used primarily to open "windows" in the material in order to permit the introduction of certain chemical substances, which in turn result in the formation of transistors, interconnections, etc.

Useful Articles. Courts have consistently refused to extend copyright protection to useful articles as such. A District Court in a case involving the design of a radio cabinet found that: "Copyright infringement, however, can only be based upon appropriation of subject matter. It is conceded that the idea, as distinguished from the expression

10. In addition, the Copyright Office will refuse to register a claim to copyright in a chip product or design based on the contention that the chip represents the published version or embodiment of a copyrightable (and, perhaps, registered) technical drawing. An action was filed against the Office in 1977 to compel such registration, but the case was withdrawn without prejudice on the understanding that the Office would file the chip in its correspondence records, while not accepting it as a deposit copy. Intel Corp v. Ringer, C 77-2848 (N.D. Cal., October 10, 1978). A suit has been filed to establish the validity of a claimed copyright in the Zilog, Inc Z80 microprocessor chip. Zilog, Inc. v. Nippon Electric Co. Ltd. (NEC) of Tokyo, CIV. NO. C-83-1241 WHO (N.D. Cal., March 1983) Copyright registration has been made as a technical drawing based on a paper blueprint-type deposit. A patent has apparently issued for the microprocessor apparatus and method of the Z80.

of it, has utility and that the arrangement has a functional value. These things are not copyrightable attributes of a design. The fact that the defendant's radio cabinets answer the foregoing description establishes nothing more than it has made use of certain structural features there indicated having functional utility." Clair v. Philadelphia Storage Battery Co., 43 F. Supp. 286, 287 (E.D. Pa. 1941). The Court of Appeals for the Seventh Circuit reached an analogous decision in the case of Taylor Instrument Companies v. Fawley-Brost Co., 129 F.2d 98 (7th Cir. 1943), cert. denied, 321 U.S. 785 (1943). In the Taylor Instrument case, the court held that:

> The proof, as well as an examination of plaintiff's recording thermometer, including its chart, leaves no room for doubt but that the latter is a mechanical element of the instrument of which it is an integral part. The chart is as indispensable to the operation of a recording thermometer as are any of the other elements. They are interdependent ... the 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 and that the recognition of an exclusive property right therein would be, in the words of the Supreme Court in the Baker case, "a surprise and fraud on the public."

Id. at 100; see also Brown Instrument Co. v. Warner, 161 F.2d 910 (D.C. Cir. 1947), cert. denied, 332 U.S. 801 (1947).

Artistic work-separability test. Although in the years following the landmark decision in Mazer v. Stein, 347 U.S. 201 (1954), there was arguably a certain widening of the scope of copyright protection for artistic works incorporated in useful articles, the courts continued to deny copyright to useful articles per se. The decision in SCOA Industries, Inc. v. Famolare, Inc., 192 U.S.P.Q. 216 (S.D.N.Y. 1976), may help to illustrate this point.

The controversy in the Famolare case centered on "a design for a thick rubber shoe sole which features several pronounced corrugations (or 'waves') on the bottom, a pattern of raised wavy lines on the side, and another pattern of raised lines on the bottom with a bicycle design, the words 'Get There', 'Patent Pending' and 'Made in Italy' also on the bottom." Id. at 217. Although a certificate of registration was issued by the Copyright Office, the court found that the certificate could not be accepted "as prima facie evidence of a valid copyright to anything except the bicycle design." Id. at 218. It went on to state that:

> There can be no valid copyright in troughs in the sole or wavy lines on the sides. These have no existence as works of art and if they did have, lack even the minimum originality needed for copyright. ... A shoe sole is an object whose intrinsic function is utilitarian. ... It is concluded, in agreement with the Copyright Office, that the troughs, waves and lines which appear on the shoe sole cannot be identified and do not exist independently as works of art.

Id.; see also Esquire v. Ringer, 591 F.2d 796 cert. denied, 440 U.S. 908 (1979).

The separable artistic features doctrine enunciated by the Copyright Office in applying the Mazer decision has now been specifically incorporated in the copyright law. As defined in section 101 of the Copyright Act of 1976, "pictorial, graphic, and sculptural works" include "works of artistic craftsmanship insofar as their form but not their mechanical or utilitarian aspects are concerned; the design of a useful article ... shall be considered a pictorial, graphic, or sculptural work only if, and only to the extent that, such design incorporates pictorial, graphic, or sculptural features that can be identified separately from, and are capable of existing independently of, the utilitarian aspects of the article." 17 U.S.C. §101 (Supp. IV 1980). In commenting on this definition, the House Committee on the Judiciary made clear that it had no intention of extending copyright to useful articles as such. With respect to works of industrial design, the Committee clearly stated:

> Unless the shape of an automobile, airplane, ladies' dress, food processor, television set, or any other industrial product contains some element that, physically or conceptually, can be identified as separable from the utilitarian aspects of that article, the design would not be copyrighted under the bill. The test of separability and independence from "the utilitarian aspects of the article" does not depend upon the nature of the design — that is, even if the appearance of an article is determined by esthetic (as opposed to functional) considerations, only elements, if any, which can be identified separately from the useful article as such are copyrightable. And even if the three-dimensional design contains some such element (for example, a carving on the back of a chair or a floral relief design on silver flatware), copyright protection would extend only to that element, and would not cover the over-all configuration of the utilitarian article as such.

Report of House Committee on the Judiciary to accompany S. 22, H.R. Rep. No. 94-1476, 94th Cong., 2d Sess. 51 (1976).

The boundaries of the new definition of "pictorial, graphic, and sculptural works" have been tested in a number of cases since the 1976 Act entered into force on January 1, 1978, and the courts have consistently refused to extend copyright protection to shapes of useful articles as such. The outside limits of copyrightable subject matter were explored in a recent case which the court described as being on "a razor's edge of copyright law." Kieselstein-Cord v. Accessories by Pearl, Inc., 632 F.2d 989, 990 (2d Cir. 1980). Discussing the scope of the useful articles definition in the 1976 Act, the court was able to identify in the belt buckles (registered as jewelry by the Copyright Office) certain elements that were conceptually separable from their subsidiary utilitarian function. See 632 F.2d at 993. No such separable elements were found in a case involving the design of wire-spoked automobile wheel covers. Norris Industries v. International Tel. & Tel. Corp., and Ladd, 696 F.2d 918 (11th Cir. 1983). The court found that the useful article did "not contain a superfluous sculptural design, serving no function, that can be identified apart from the wheel covers themselves." 696 F.2d at 924.

The proposed extension of copyright to the topology of semiconductor chip products in H.R. 1028 would grant protection to useful aspects of useful articles, which apparently have no separable artistic features. Moreover, notwithstanding section 113(b) of the Act, rights would be granted to control the making and distribution of a useful article. The bill therefore represents a marked departure from the current law's treatment of utilitarian articles as such. Whether such a step should be taken may be questioned.

3. Computer programs. Computer programs constitute copyrightable subject matter. The Copyright Act classifies these works as a species of literary works and defines them as "a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result." 17 U.S.C. 101. The Copyright Office registers computer programs that constitute original works of authorship.

Although computer programs may be fixed in chips and may be employed as "tools" in the designing of chips (CAD or computer-aided design), the semiconductor chip industry apparently does not believe that copyright for the computer program is sufficient to protect their designs. As we discuss more fully in a later section of this statement,[11] this inadequacy of protection arises either because: 1) some chips may not embody programs at the time they are exposed to duplication; 2) the part of

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11. Section IV, "Need for Protection."

a chip containing the program may not be duplicated; 3) the owner of the program copyright may not own rights in the design of the chip; or 4) the scope of protection for designs developed with the assistance of a computer program is uncertain (i.e., to what extent, if any, would duplication of the CAD-developed "work" infringe the copyright in the program?).

B. Previous Consideration of Semiconductor Chip Protection

Whether, and to what extent, the design or layout of semiconductor chips should be afforded copyright protection was raised in the closing days of the National Commission on New Technological Uses of Copyrighted Works; however, there was not sufficient time remaining for the Commission to deal adequately with the matter.

Further consideration was given to what was termed the "imprinted design patterns on semiconductor chips" during a hearing on April 16, 1979 before the House Subcommittee on Courts, Civil Liberties, and the Administration of Justice. The legislation then pending before the Subcommittee was a bill, H.R. 1007, to amend section 101 of title 17 U.S.C. to add the following new sentence at the end of the definition of "Pictorial, graphic, and sculptural works": "Such pictorial, graphic, and sculptural works shall also include the photographic masks used to imprint patterns on integrated circuit chips and include the imprinted patterns themselves even though they are used in connection with the manufacture of, or incorporated in a useful article."

The Copyright Office testified at the hearing in support of the principle of protection for the imprinted design patterns on semiconductor chips covered by H.R. 1007. However, similar to our present testimony, the Office raised several major questions for further Congressional consideration:

1. Within the constraints of chip purpose and size, are the layouts, masks, and patterns dictated by the chip's function, or do they represent a creative choice from among different possibilities?[12/] If the former, the elements would be uncopyrightable concepts, principles or ideas rather than copyrightable works of authorship.
2. What are the limits of protection presently available for the various elements — schematic drawings, mylar sheets, photographic masks, imprinted patterns, and programs — stored in the chips, and programs used in generating the chip?
3. In light of existing and anticipated industry structure and technology, should copyright protection of masks and imprinted patterns be subject to specific limitations regarding term of protection, scope of rights, or nature of infringement remedies?[13/]

Many witnesses appeared from the semiconductor chip industry either for or against the 1979 bill, H.R. 1007. Supporting witnesses argued that protection was essential to combat the rising threat of unfair

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12. To date, the Copyright Office has concluded that designs of semiconductor chips are not "original works of authorship" under the current Act. Later in this statement we consider whether Congress could constitutionally protect chips under the Copyright-Patent Clause.

13. Statement of Jon Baumgarten, Copyright Protection for Imprinted Design Patterns on Semiconductor Chips, Hearing Before the Subcommittee on Courts, Civil Liberties, and the Administration of Justice, House Committee on the Judiciary, 96th Cong., 1st Sess. on H.R. 1007, 14-15 (1979). (Hereafter, the 1979 Hearing).

competition from chip pirates. They argued that the ability of firms to invest in development and research would be adversely affected by unchecked piracy, and they pointed to the threatening competition from Japan. Patent protection was available for only a few processes in creating chips. Supporters of H.R. 1007 saw it as a simple, constitutionally sound remedy against duplication of creative products.

Opponents of H.R. 1007 argued that protection would reduce the ability of U.S. firms to compete in the world market and would increase costs to U.S. consumers.[14] They argued that

> chips, as utilitarian articles, cannot appropriately be protected by copyright;[15]
>
> existing copyright protection for computer programs and patent protection for certain processes was adequate;[16]
>
> industry practices of "second sourcing" or "reverse engineering" would be inhibited if not illegal;[17]
>
> existing copyright remedies (especially the remedy allowing destruction of infringing articles) would work an undue hardship;[18]
>
> protection was being sought for ideas;[19] and
>
> copyright gives more protection than is necessary to encourage innovation in this field.[20]

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14. 1979 Hearing at 51 (statement of John Finch, Vice-President, National Semiconductor Corp.)

15. Id. at 52-53.

16. Id. at 54.

17. Id.

18. Id. at 54-55.

19. 1979 Hearing at 56 (statement of James M. Early, Division Vice-President, Fairchild Camera & Instrument Corp.).

20. 1979 Hearing at 74 (letter of Quincy Rodgers, Director-Governmental Affairs, General Instrument Corp.).

One person argued that protection is needed, but not under copyright; he suggested legislation affording protection against misappropriation of proprietary information by illicit means.[21]

Apparently because of the force of the opposition to H.R. 1007, there was no further action on the bill.

Senator Mathias and Congressman Edwards introduced S. 3117 and H.R. 7207 respectively near the end of the 97th Congress, for discussion purposes. These bills were virtually the same as H.R. 1028 and would have made mask works a new copyrightable subject matter category as a means of protecting the design or layout of semiconductor chips.

III. CHIP TECHNOLOGY

As we informed the Congress in 1979, the Copyright Office does not consider itself expert in the field of semiconductor chip technology. In order to analyze the issues affecting copyright for the design of chips, however, the Office has reviewed the technical literature and has prepared the following lay explanation of the technology.

A. Overview of Chip Design and Manufacture

There are several distinct steps in the development of a microelectronic circuit to be formed in semiconductor material. The process usually starts with an abstract description of the electrical function to be performed by a particular circuit chip. In successive steps in the design process, the electrical specifications of the device are then set forth with increasing precision. At the risk of oversimplification, the process may be compared to the work of a city planner who drafts a plan to build a town in a given location that will have houses, a school and a

21. Id. at 76.

shopping center. The planner then hires an architect to design the town. Blueprints are drawn that specify where the streets are to be situated, how large the shopping center will be, what types of houses will be built and other specifics. Eventually, consideration is given to such minor details as the plumbing to be installed in the individual houses.

Once a detailed schematic or logic diagram of the device has been made, or the schematic data has been set forth in a higher level representation (e.g., described symbolically), a decision is made on the geometrical placement and interconnection of the components. Today, this layout is commonly done with the aid of complex computer programs.[22/] Although there is much research under way to automate completely the design effort, a layout designer using a computer-aided design system is still required to make choices concerning particular layout and interconnection patterns.

During the layout process, the design may be displayed on a CRT screen or reproduced using a plotter for verification purposes. After the layout of the microelectronic circuit is finalized, it is usually fixed in a pattern generation tape that is sent for use in the production of the particular device. Although the layout and interconnection patterns encoded in the tape may be "written" directly on a silicon wafer using electron-beam technology, the transfer of the patterns by a photolithographic process using a series of masks is now industry standard.

B. Chip Design and Manufacture - A More Detailed Account

Although the steps in developing microelectronic circuits or other devices in semiconductor material may vary widely, it is possible to group them in four general stages for discussion purposes.

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22. For a concise summary of advances in computer-aided design, see M. Feuer, VLSI Design Automation: An Introduction, 71 Proceedings of the IEEE 5, (1983).

1. Electrical behavior. The process of producing a semiconductor chip product usually starts with a general description of the electrical function to be performed by a particular device. An outline or "floor plan" of the device is sometimes made.

2. Description of circuits. On the basis of the abstract description of the behavior of the device to be formed, an engineer sets forth the electrical specifications of the device in increasing detail. The schematic data may be set forth in a logic diagram, or the data may be described in a higher level representation.

3. Layout. Just as there are many different circuits that may be selected to perform a particular electrical function, there are also different ways to arrange the components in semiconductor material. The focus of the semiconductor chip protection legislation appears to be the determinations of the layout designer, either alone or with the assistance of a logic designer or process expert, with respect to the structural placement of the components of a device and the routing paths to interconnect these components. The layout and interconnection patterns generated by the layout designer would be deemed "mask works" under the proposals in H.R. 1028.

The eventual commercial success of a semiconductor chip product often depends on the ability of the layout designer to achieve an optimized layout configuration. In attempting to provide the highest functional component density in order to reduce the chip area per circuit function, the layout designer is subject to certain layout constraints.

The layout designer, however, has powerful tools to help in producing the geometrical layout patterns for each layer of a microelectronic circuit or other device. In recent years, computer-aided design systems have become commercially available that, once a layout designer inputs specific schematic data from a logic diagram or a higher-level symbolic description, are capable of making most of the placement and routing determinations. Although it appears likely that the layout process may eventually be completely automated, technical skill is still required of a chip architect in the layout design.

A layout design is usually based upon a preexisting technical drawing or other representation of schematic data. Where a designer uses an interactive computer system to determine the placement of the electrical elements on the surface of a semiconductor wafer and the routing of the "wires", and today this is standard industry practice, the first step in the layout process is the inputting of the schematic data into the computer. The layout designer then manipulates the schematic database, with the assistance of computer programs, to produce the layout and interconnection patterns to be used in the fabrication of a microelectronic circuit or other devices.

4. Fabrication of devices in semiconductor material. Once a layout design is finalized, the encoded layout patterns are used in the patterning and fabrication processes to implement the desired integrated system. While the patterns are usually transferred to a silicon wafer by a photolithographic process using a series of masks, it is now possible to "write" the patterns directly on a wafer using electron-beam technology. Apparently, this new method of imprinting patterns on semiconductor material is intended to be covered by H.R. 1028. In his detailed analysis of the bill, Congressman Edwards stated that: "The fourth of these exclusive rights is inclusive of all means of embodying the images of a

mask onto a chip. This includes not only the use of masks to do so, but also the new technological process of impressing the image directly onto the chip with the aid of a computer-driven light beam."23/

IV. NEED FOR PROTECTION

The need for protection against chip piracy has been concisely and forcefully set out by Congressman Edwards in remarks accompanying the introduction of H.R. 1028.

> 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 chip firms years, consume thousands of hours of their engineers' and technicians' time, and cost millions of dollars.
>
> Yet, a pirate firm can photograph the chip and its layers, and in several months and for a cost of less than $50,000 duplicate the mask work of the innovator.
>
> Continuation of such piracy may make it impossible for the semicondutor industry to continue to invest in development of new chips. Thus, unless this piracy is stopped, the industrial leadership enjoyed in the past by the American semiconductor industry may vanish. Present law offers American industry only limited protection against this misappropriation of their technology.24/

The Copyright Office is in accord with these views, and we agree that the present law is inadequate to stem chip piracy. Since the last Congressional hearings on chip piracy, the need for protection has become even clearer. This seems true notwithstanding increased reliance on computer programs to design and create layouts of chips and the judicial developments in the field of computer programs.25/

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23. 129 Cong. Rec. Daily H 643, H 644 (February 24, 1983).

24. Id. at H 643.

25. Recent cases upholding copyright in computer programs include: Tandy Corp. v. Personal Micro Computers, Inc., 524 F. Supp. 171 (N.D. Cal., 1981); GCA MAP Corp. v. Chance, Civ. No. C-82-1063 (N.D. Cal. Aug. 31, 1982); Williams Electronics, Inc. v. Artic Intern. Inc., 685

A. Programs Distinguished from Chips.

Providing protection for computer programs is not equivalent to providing protection for semiconductor chips per se. As Senator Mathias has pointed out[26] the semiconductor or integrated circuit chip is a marvel of modern solid state electronics. To a large measure, the chip has the capacity to combine, in a few square millimeters, the major elements of a conventional computer system — the central information processor and large quantities of information storage capacity. In many cases processor and storage capacity may equal the typical computer system of only 10 years ago.

Thus, the chip, at once, may carry out two fundamental functions of a computer system: 1) computing or processing information; and 2) storing either permanently or temporarily significant quantities of data. As well, some chips may have only one of those functions. The primary function of a whole family of chips is to store programs or data. These are the so-called ROM (read-only-memory) chip, the PROM (programmable-read-only-memory) chip, and the EPROM (erasable PROM) chip. Functionally, these chips can substitute for magnetic tape, disk, or core memory in a conventional computer system. Other chips have as their primary function to be a computer itself; to process and manipulate information by the execution of a computer program stored in a memory chip or in a portion of the processor chip designed to serve as a memory.

F.2d 870 (3d Cir. 1982); Hubco Data Products Corp. v. Management Assistance, Inc., Civ. No. 81-1295 (D. Idaho, Feb. 3, 1983); Apple Computer, Inc. v. Formula Intern., Inc., Civ. No. 82-5015-IH (C.D. Cal., April 11, 1983); Midway Mfg. Co. v. Artic Intern., Inc., Civ. No. 82-1607 (7th Cir., April 11, 1983); and Apple Computer, Inc. v. Franklin Computer Corp., No. 82-1582 (3rd Cir., August 30, 1983).

26. 129 Cong. Rec. at S 5992.

The copyright law presently provides protection for computer programs independently from their medium of fixation. It protects a program whether it is stored in a chip, a disk, a tape, or printed out on paper. Protection for the program does not protect the chip in which it is stored any more than protection for a novel protects the book format in which it is stored.

Providing protection for that portion of a chip or the entire chip that is the functional equivalent of the processor hardware in a conventional computer system is a complex matter. As discussed earlier, copyright protection is presently available for the technical drawings that are prepared at various stages in the manufacture of a chip. Protection apparently does not extend to the chip form in which those works may ultimately be embodied. That lack of protection, of course, is the reason for this inquiry.

B. Proprietary Interests Distinguished.

Just as it is possible to distinguish among types of chips, it is possible and, perhaps, even necessary to distinguish among the various proprietary interests that are interrelated and brought together in chip technology. The owner of the proprietary interest, if any, in the layout or design of the chip may or may not be the owner of the proprietary interest in a program embodied in that chip.

For example, the producer of an electronic video game may own the copyright in the audio-visual work that is the game (but there can be no copyright in the idea for the game). Such works are typically embodied in memory chips of the ROM or PROM types. The typical arrangement is for the game proprietor to develop the game and the computer program or programs necessary to create the sights and sounds presented on the cathode ray tube display in the game. When the programs are fully developed — tested, debugged and determined to be reliable — the proprietor will have them embodied in a chip. If a small production run is contemplated, the game manufacturer may load the program in a PROM purchased from the chip manufacturer. If a large production run is contemplated, such as is the case in a home video game, the game producer may have a ROM produced by a chip manufacturer that permanently and unalterably stores the program.

In both of these instances, the game producer is protected by the copyright in the audio-visual work and the underlying program.[27] In neither instance is the proprietary interest of the chip manufacturer protected. It is true that in either case, the audio-visual work or the game play program may be copied by copying the chip. The game proprietor could use copyright to prevent that copying, but only to the extent it involved the program or the audio-visual work.

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27. As noted in Apple Computer, Inc. v. Franklin Computer, Corp., 545 F. Supp., at 818, n. 8, "[i]n the last year, a number of courts have held that a ROM-based object program used to create visual displays in arcade games is properly copyright protected," citing: Midway Mfg. Co. v. Artic Intern., Inc., 547 F. Supp. 999 (N.D. Ill. 1982) [now aff'd, Civ. No. 82-1607 (7th Cir., April 11, 1983); Atari, Inc. v. North American Philips Consumer Electronics Corp., 672 F.2d 607 (7th Cir. 1982); Stern Electronics, Inc. v. Kaufman, 669 F.2d 852 (2d Cir. 1982); Atari, Inc. v. Amusement World, Inc., 547 F. Supp. 222 (D. Md. 1981); Midway Mfg. Co. v. Dirkschneider, 543 F. Supp. 466 (D. Neb. 1981); Williams Electronics, Inc. v. Artic Intern., Inc., 685 F.2d 870 (3d Cir. 1982); and Cinematronics, Inc. v. K. Noma Enterprise Co., Civ. No. 81-489 PHX-EHC (D. Ariz., May 22, 1981).

To date, the courts have generally found that separate copyrights may exist in an audio-visual work fixed in chips and in the computer program which operates the video game, but losing counsel have sometimes argued that the audio-visual work is not fixed and that copyright exists only in the computer program.

V. ANALYSIS OF H.R. 1028

As indicated, the Copyright Office shares the belief of Congressman Edwards that semiconductor chips are products which are vitally important to the American economy and should be protected against piracy. The Office believes, however, that there are substantial questions about certain features of H.R. 1028 which should be reflected upon before any bill is enacted to protect semiconductor chips, and the masks from which they are generally made. Several features of H.R. 1028 represent a positive attempt to meet many of the objections lodged against the approach of the 1979 bill. In this section, the Office analyzes H.R. 1028 and expresses its specific concerns about the bill. In the next two sections we analyze and discuss first the Senate Subcommittee version of S. 1201 (which has been reported to the Senate Judiciary Committee), and second, a Copyright Office draft bill, which would protect chips under design principles. As of possible assistance to the subcommittee, the Office, in Appendix A, compares the salient features of H.R. 1028, S. 1201 as reported, and the design approach.

A. Basic Features.

H.R. 1028 would create a new subject matter category of copyrightable work known as "mask works." This new category is specially defined to encompass the skills and creativity, if any, employed in the intermediate stages of producing semiconductor chips (that is, between the first technical drawing, if any, and the finished chip product). The ultimate objective is to protect the finished chip against unauthorized duplication. As a mark of this bill's completely different approach compared with the 1979 bill, mask works are specifically declared not to be deemed pictorial, graphic, or sculptural works. But the objective is the same: protection of the finished chip.

Other major and distinguishing features of this bill include:

1. limited term of protection -- ten years from first authorized distribution, use in a commercial product, or manufacture in commercial quantities;

2. new or modified exclusive rights — to embody the work in a mask; to distribute the work; to use a mask embodying the work to manufacture chips; in the manufacturing process, substantially to reproduce the work on material intended to be part of a chip product; and to distribute or use a chip product made as described in the last two rights;

3. compulsory license — the purchaser of an infringing chip product, having no notice of infringement, who commits substantial funds to the use of a chip and would suffer substantial financial detriment if enjoined, is entitled to a compulsory license based on an offer to pay the copyright owner a reasonable royalty;

4. "innocent infringer" provision — a bona fide good faith purchaser of an infringing chip product is not liable as an infringer with respect to the use or distribution of the chip products before the purchaser has notice of the infringement; and

5. effective date — the bill would not protect chips products or masks manufactured or imported into the U.S. before the effective date, which is 90 days after enactment.

While the Office is not prepared to endorse the specific copyright solution advanced by H.R. 1028, we note that the limitation on term, the compulsory license, and the innocent infringer provisions in principle respond to concerns raised in 1979 by the Copyright Office and segments of the semiconductor chip industry about the length of protection and about the perhaps unduly broad scope of traditional copyright infringement protection when applied to semiconductor chips.

For example, the innocent infringer provision would insulate unconscious infringers from copyright liability (traditional copyright law protects against both conscious and unconscious infringement).28/ The compulsory license, although it should be given further thought, does provide a modest encouragement of voluntary agreements while avoiding the otherwise draconian impact of injunctive relief under this bill against a bona fide purchaser of chip products.

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28. In a copyright infringement case, the plaintiff has the burden of proving unlawful copying, which ordinarily is established by proof of defendant's access to the copyrighted work, and substantial similarity between the alleged infringing work and the copyrighted work. However, once the plaintiff offers evidence of access and substantial similarity, the burden shifts to the defendant to prove independent creation rather than copying, to account for the substantial similarity between the works. M. Nimmer, NIMMER ON COPYRIGHT, §13.01[B], page 13-8 (1982 ed.) Both intentional and nonintentional copying are proscribed. Fisher v. Dillingham, 298 Fed. 145 (S.D.N.Y. 1924) (Jerome Kern found to have infringed by unconscious copying).

B. Concerns about H.R. 1028

The Copyright Office tends to believe that a design approach to semiconductor chip protection is preferable to a copyright solution as a matter of intellectual property policy. While careful redrafting may resolve some or all of the technical problems noted in this section, a design approach avoids the necessity of confronting them. The Office is also concerned that some of the problems are of a fundamental character, relating to the basic approach of the pending bill, and may prove exceedingly difficult to resolve.

In this section, we analyze the major technical and policy concerns: what objects are "copies;" subject matter/constitutional concerns; distinction between "mask works" and other copyrightable works embodied in chips; the novel "use" right; and the compulsory license.

1. What are "copies"? Since the reproduction and distribution of "copies" are the fundamental rights conferred by most copyright statutes, issues or questions regarding the meaning of the term "copies" have great, fundamental significance. By providing that the term "copy" includes chips with respect to only nine of the 36 sections in the copyright law where the term is used, H.R. 1028 would create a distinction as between those sections of the law in which chips are treated as the equivalent of "copies" and those in which they are not.

Of crucial significance is the point that section 101 — the definitions section — is not included within the nine sections specified. The consequences of this seem grave: can a mask work be published under the Act, since the term "copies" in the definition of "publication" does not include chip products?; If the object embodying the copyrighted work is not capable of publication, the notice requirements of the Act do not apply. It would appear that chip products may no longer constitute "copies" of computer programs and other works embodied therein because of the bill. Obviously, this result is unintended. Nevertheless, the drafters appear to have destroyed one of the fundamental tenets of the current Act: copyrightable works are embodied either in "copies" or "phonorecords." The result seems to be that we now have three kinds of material objects embodying copyrightable subject matter; copies, phonorecords, and semiconductor chip products — but the latter for limited purposes only.

This is a fundamental issue of the greatest significance, and must be resolved before enactment of the bill.

2. Subject matter/constitutional issue.

The proposed definitions of "semiconductor chip product," "mask work," and "mask" would arguably dramatically alter the fabric of copyright by extending copyright to "product[s]...intended to perform electronic circuitry functions" and "product[s] that [are]...discover[ies], or the manufacture, use, or distribution of which [are] in or affect commerce." The constitutional basis for every portion of every Copyright Act in Amercian history has been Article I, section 8, clause 8 of the Constitution, which speaks in terms of "Writings."

This explicit extension of copyright to electronic devices represents a dramatic departure from 200 years of copyright legislation. Congress has never enacted a copyright law based on the Interstate Commerce Clause. Moreover, there is presently a statutory bar, not repealed by the bill as drafted, against affording copyright to "discoveries."[29/] In

29. Section 102(b) of the Copyright Act specifically prohibits copyright in a "discovery" — "regardless of the form in which it is described, explained, illustrated or embodied in ... [an original work of authorship]."

addition, there is substantial precedential weight for the proposition that utilitarian devices are ineligible for copyright on the ground that they are not "writings." While that term has been construed ever more broadly as such media as photography, motion pictures, sound recordings, and television have developed, it has never been held to apply to purely utilitarian devices.

The bill seeks to finesse the useful article issue by creating a new subject matter category, which purports to be nonutilitarian. Nevertheless, Sec. 2, Clause (3) attempts to establish a constitutional basis for protecting the material object — semiconductor chip products. It is the constitutional basis of the copyrightable subject matter — "mask works" — that is ordinarily significant. It is likely that, if the Congress should decide that a "mask work" is a "writing," the courts would uphold that decision.

The Office suggests further reflection about Clause (3) of the definition of semiconductor chip product. In any event, we recommend elimination of the reference to "discovery" in that clause.

3. Distinction between mask works and other works. One of the most difficult tasks in considering how best to afford intellectual property rights with respect to semiconductor chips is separating the notion of protecting the design or layout of the chip from protecting the work of authorship which may (but need not be) contained therein. It is possible to store conventional copyrighted material, such as written text, on chips, in which case copyright would clearly apply to the copying of such works. Unconventional materials (at least in copyright terms), such as video games and computer programs, may also be stored therein. The jurisprudence of

the last three years permits the observation that courts have ordinarily been willing to grant relief to copyright proprietors whose works, distributed in chip form, were the subjects of unauthorized reproductions.[30]

Unfortunately, the selective inclusion of semiconductor chips as "copies" under certain sections of the Copyright Act, but not under others, may lead to confusion about where chips fit within the copyright law and, at root, what the rights of chip-copyright owners[31] are.

4. New exclusive rights -- the "use" right.

Some of the proposed new exclusive rights for chip-copyright owners appear to track traditional rights.[32] The right to embody the mask work in a mask looks rather similar to the classic "copyright"[33] now codified in section 106(1), *i.e.*, the right to reproduce, in copies, the copyrighted work. The right to distribute mask and chip works looks almost exactly like the right provided already in section 106(3). On the other hand, the "use" right proposed here seems unrelated to anything known to any copyright system, past or present, here or abroad. It is a right found in patent law, but alien to copyright law. Such a right appears, by its terms, to give a copyright owner the right to control the manufacture of a

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30. *Supra*, note 25.

31. By "chip-copyright owners" we mean the owner of the new rights in the new subject matter category "mask works," as established in H.R. 1028.

32. The structure of the bill, which deliberately attempts to confine the term "copy" in relation to semiconductor chips, to only a few sections of the statute, necessitates this tracking of certin rights.

33. However, the bill, for the first time, would grant a right to make a useful article.

useful article and to control in every respect how a bona fide purchaser of a chip product uses that copy (subject to the compulsory license and innocent infringer provisions).

While copyright has long forbidden specific restricted acts, this provision appears to permit chip-copyright owners to define any use of which they disapprove as infringing.

Control over copying, adaptation, distribution, public performance, and public display are the rights which presently comprise American copyright. The law is rather clear about the meaning of those rights, and certain limitations on them, but the ability of a chip-copyright owner to control the use of a semiconductor chip product would make him or her far more powerful, and customers (and, for that matter, customers' customers) far less free in their businesses, than any other class of copyright users.[34]

The compulsory license and innocent infringer provisions establish some limits to the broad reach of the proposed "use" right, but those chip purchasers who cannot meet the terms of those provisions would apparently be prohibited from using a lawfully acquired chip. The Copyright Office does not believe such an unprecedented right is justified.

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34. In the case of a new subject matter category, the exclusive rights perhaps should be somewhat limited rather than expanded, in comparison with the rights granted traditional subject matter. Sound recordings, for example, were accorded rights only against exact, unauthorized duplication and distribution initially, in 1972. The 1976 Copyright Act later extended a modified adaptation right, but the public performance right has still not been granted to sound recordings.

5. Compulsory license.

The "compulsory license" provisions in the bill are markedly different than existing compulsory licenses in the Copyright Act. The chip compulsory license could only be invoked by a bona fide purchaser of infringing products who bought without having notice of infringement, who committed substantial funds to the use of the infringing product, who offered to pay the copyright owner a "reasonable" royalty, and who could not receive the product directly from the copyright owner or licensee at a "reasonable price." Whether the purchaser has actually received notice of infringement, what amounts to "substantial funds," and the meaning of "reasonable royalty" and of "reasonable price," are left undefined by the bill.

Perhaps, clarification and explication in the Committee report would satisfy some of our concerns about this new "compulsory license." Without further clarification in the bill or the report, most of these terms may be an invitation to litigation, thus virtually guaranteeing that the licensing procedure will be both slow and unpredictable. It might be more desirable to require the services of a non-judicial arbitrator in determining the eligibility and price issues associated with this somewhat complex licensing scheme, if "voluntary" negotiations fail.

6. Concluding thoughts. The introduction of a "mini-term" of ten years into an otherwise uniform law, although not uncommon in foreign copyright statutes, may cause some problems, especially if the relationship between "mask works" and other works embodied in chips is not entirely clear. Copyright now arises in every type of work upon its creation, while this proposal would have chip-copyrights last for ten year from the first (query: the earliest of?) distribution, use, or manufacture.

The problems seem in trying to create one class of works subject to a set of special rules, including a very different period of protection, demonstrate how difficult it may be to fit semiconductor chips into copyright. The very brevity of the proposed term,35/ when compared with life-plus-fifty years or seventy-five years for other works, suggests that traditional copyright protection may not be appropriate for these works. Likewise, the bill's statements that chip products are devices (i.e, they perform electronic circuitry functions), or discoveries, or products distributed in interstate commerce, suggest that they do not fit easily, if at all, into the constitutional class of works for which Congress may authorize copyright: "writings."

VI. COMMENTS ON S. 1201 (REVISED)

The concerns expressed by the Copyright Office regarding H.R. 1028 are the same as those expressed by us and several others witnesses before the Senate Subcommittee on Patents, Copyrights, and Trademarks at a hearing held on May 19, 1983. In response to those comments, the Senate Subcommittee reported S. 1201 with substantial amendments. In general, the Copyright Office believes that the Senate Subcommittee version represents an improvement over the original bill, but several major problems remain.36/

35. The Copyright Office does not oppose a short term of protection for chips; indeed, overprotection was one of the major objections to the 1979 bill (H.R. 1007).

36. Notwithstanding the commendable effort by the Senate Subcommittee to meet the technical objections to the original bill, the following major problem areas remain, in the opinion of the Office: 1) what are "copies;" 2) relationship between chip copyright and copyright in other works embodied in chip products; 3) inclusion of a constitutional basis for a useful article (semiconductor chip product) rather than for the subject matter of copyright under the bill (the mask work); 4) scope of "substantially to reproduce . . . an image of the

The Senate Subcommittee version makes the following major changes in the semiconductor chip bill: (1) the addition of an express exemption to permit "reverse engineering;" (2) elimination of the "use right" from the list of exclusive rights; (3) the addition of a savings clause to clarify that nothing in the bill affects the existing rights of copyright owners nor imposes liability on purchasers of chip products who acquired the products from the copyright owner before the effective date of the Act; (4) modification of the effective date clause to provide for some retroactive protection; and (5) elimination of the compulsory license and substitution of an expanded "innocent infringer" provision. Other technical amendments were made which will not be discussed here.[37]

1. Reverse engineering. At the Senate hearing most witnesses assumed that the bill was intended to make reverse engineering a noninfringing activity, but there was (and is) considerable confusion about the meaning of this phrase. The Senate Subcommittee version adds a new section 119, explicitly conferring a "right of reverse engineering."

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mask work;" 5) relationship between reverse engineering provision and fair use (section 107 of the Copyright Act); 6) the expanded innocent infringer provision (garbled and confused; unclear relationship between paragraph (a) and (b) of new Sec. 7, especially in view of different terminology and confusing references to "use" of the chip product); 7) lack of clarity in the savings clause (new Sec. 9) (reference to "prior to its amendment" seems inappropriate); and 8) lack of clarity in the effective date provision (new Sec. 10) (probably an overbroad provision — mask works are given some protection irrespective of the date of creation and first commercial distribution).

37. For example, the term "discovery" has been omitted from the definition of semiconductor chip product; an inadvertent reference to "mask" in the third sentence of the definition of the word "mask" has been eliminated.

While this provision improves the bill, the line between infringing and noninfringing activities is difficult to draw, and the concept of reverse engineering eludes clear understanding. What constitutes the sort of "reverse engineering" that should be permissible in accordance with the traditional copyright principles regarding the separability of idea and expression? In other words, how does the section 102(b) exclusion of ideas, systems, methods of operation and the like from copyright protection in principle apply to semiconductor chip products, masks and mask works. In an effort to illuminate the issue, the Copyright Office offers the following tentative thoughts about the probable interpretation of the right of reverse engineering.

An analytical key may be the concept of "reverse engineering" common to trade secret law. In Mostek Corp. v. Inmos, Ltd., 203 U.S.P.Q. 383 (N.D. Tex. 1978) the court discussed the practice of reverse engineering in the semiconductor industry. It defined the practice as "analyzing a competitors' product to discover its design and manufacturing processes [footnote omitted]" id. at 386. The Supreme Court has as well defined "reverse engineering" in general terms as "starting with the known product and working backward to divine the process which aided in its development or manufacture.". Kewanee v. Bicron, 416 U.S. 470, 181 U.S.P.Q. 673 (1974).

This concept has been discussed in the copyright idea/expression context in some of the recent computer software cases. In particular the third circuit's decision in the recent Apple v. Franklin discussed the conceptual separation of idea and form of expression in regard to computer operating systems. It has been held that a competitor can employ the idea, method, process, or system of operation embodied in a computer program to develop a program that will achieve the same functional result as the original program. Hubco Data Products, Inc. v. Management Assistance, Inc., Civil No. 81-1295, Copyright L. Rep. ¶25,529 (D. Idaho 1983); see also Apple Computer, Inc. v. Formula, 562 F. Supp. 775 (N.D. Cal. 1982).

Three hypothetical situations may be used to help illustrate the questions that may arise when seeking to determine whether a competitor's actions in the production of a chip using a preexisting chip amount to permissible "reverse engineering" or a proscribed reproduction:

1. Outright duplication of the chip through photographic reproduction of the masks from the original chip;
2. Using only the functional characteristics of the chip to design a new chip to perform exactly the same function; and
3. Making improvements on an existing chip and incorporating all or substantial parts of the existing design in the improved chip.

Application of the aforementioned principles to semiconductor chips would appear to be fairly straightforward at the extremes of (1) outright copying of the design (infringement), and (2) use of only the "function" of the chip to produce a totally new chip design (no infringement).

In accordance with the language of the bill and traditional copyright principles, outright copying of the design by any means would be precluded. This simple statement, however, may mask some difficult subsidiary issues arising from the technological processes by which these chips are designed and produced. Clearly if one strips off the plastic housing of the chip and, using a combination of chemical and electronic processes, reproduces images of each layer of the chip, this would be precluded.

This should be examined, however, for each step of the design and manufacturing process. If a competitor were to copy the reticles or masks used, this would appear to be equivalent to copying the chip itself. The same result should obtain if one copied the computer disks or tapes that contain the digitized images equivalent to the masks.

Should the same result apply if earlier, more preliminary versions leading to the final work are copied? What about the preliminary design documentation such as the circuit schematic layout? Under traditional copyright principles, especially as they have been interpreted in the computer software cases cited above, it would appear that use of the circuit schematic to design a new chip would be free of copyright liability. The language of the proposed §119 may, however, call this into question as it seems to indicate that one could, in the course of reverse engineering a chip, reproduce the mask "solely for the purpose of teaching, analyzing or evaluating ... the circuit schematic, logic flow, or organization of components utilized therein." This may imply that the protection afforded by the bill would extend to the "schematic, logic flow, or organization of components" in the chip but for the reverse engineering provision. This would clearly be a departure from accepted principles of copyright embodied in section 102(b) of the Copyright Act.

At the other extreme there appears to be agreement that one could study the chip, determine its function, logic or circuitry and then design a new chip to carry out the identical function without infringing rights in the protected chip. This of course would be in accordance with copyright law past and present, and it would seem to follow logically from the computer software decisions. Protection would be afforded to the authorship in the work, the expression of the circuit in symbology pertinent to the production of semiconductor chips, but others would be free to develop their own designs to express the circuit.

The difficulties in application of course will arise in the gray area between the two extremes. How much of a protected design could be incorporated in a new or improved chip design? When would an improved circuit be a new design? These are unanswered questions and the bill does little to offer precise guidance in this area except to suggest in the proposed 106(6)(D) that "substantially to reproduce, by optical, electronic, or other means an image of the mask work" would be an infringement. Is this the same test of substantial similarity common to the copyright system or is it some new test?

2. <u>Elimination of "Use" Right</u>. The Senate Subcommittee version eliminates the "use" right from the bundle of exclusive rights conferred on chip copyright owners. This constitutes a major improvement, which we strongly endorse.

3. <u>Savings Clause</u>. A new Sec. 9 has been added in an attempt to clarify that the existing rights of computer program copyright owners and of other copyright owners have not been adversely affected by the bill. While the intent is salutary, the Office continues to doubt, expecially because of the issue concerning what is a "copy" of a work, that the objective has been acheived. Moreover, we have particular reservations about the second sentence of this provision, since it appears to imply the existence of chip-copyright protection before the effective date, while granting relief only for those who acquire their copy from the "copyright owner" or authorized agent.

4. Retroactivity. The initial impression of the Copyright Office was that the original bill (H.R. 1028 and S. 1201) was not intended to protect mask works retroactively. As we noted in our Senate testimony, new copyrightable subject matter has traditionally been protected only prospectively. This initial impression was apparently not correct, since Sec. 9 of H.R. 1028 curtails protection for particular material objects, but not for mask works per se. The semiconductor chip industry wants some retroactive protection — not with respect to infringing acts occurring before enactment but with respect to the subject matter.

The Senate Subcommittee version now includes a more explicit provision making the Act retroactive with respect to subject matter protection. Mask works whenever created would be protected except (i) there is no liablity for acts restricted by the bill if committed prior to the effective date (the date of enactment), and (ii) infringers who commercially distributed the chip product in the United States before January 1, 1980 are not liable.

The effect of the interaction of the innocent infringer, savings clause and effective date provisions seems to be: 1) mask works whenever created are potentially subject to protection; 2) someone who purchased the chip product from the copyright owner or its licensee before enactment has no liability under the bill; 3) someone who purchased the chip product from a non-copyright owner source before enactment would be liable (possibly even if they had no "notice of the infringement"), assuming that they commit an infringing act on or after the effective date, except for an alleged infringer who commercially distributed the chip product in the U.S. prior to January 1, 1980.

Retroactivity clauses generally should be scrutinized for basic fairness and appropriateness. Their inclusion in a statute almost always requires safeguard clauses and other provisions to avoid unfairness and actual damage to those whose rights or privileges are curtailed by the law. Unless they are very carefully crafted, retroactivity clauses invite litigation.

The Copyright Office is not persuaded that the semiconductor chip industry has sustained the burden of showing the necessity for retroactive protection of mask works.

5. Expanded "innocent infringer" provision. The Senate Subcommittee version omits any compulsory license per se, but transfers the substance of the original compulsory license to an expanded "innocent infringement" provision (proposed new section 511).

The Copyright Office welcomes the elimination of the compulsory license feature. Our general position is that a compulsory license should be instituted only as a last resort, and then only to extend protection to a category of copyright owners previously unprotected. We see technical problems,[38] however, with the Senate Subcommittee's innocent infringement provisions, but refrain from a detailed discussion since the proposal is not expressly before this Subcommittee.

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38. For example, the relationship between paragraph (a) and (b) is unclear. Different terminology is used. Paragraph (a) concerns "distribution" by an innocent "purchaser." Paragraph (b) uses the phrase "made or distributed," and includes several confusing references to "use" of the allegedly infringing product.

VII. DESIGN APPROACH

Industrial design legislation, based on the copyright principle of originality, but intended to occupy a separate chapter of title 17 U.S.C. and to cover a broad array of useful articles, was passed by the Senate in 1975,[39] but ultimately failed of enactment.

In testifying before the Senate on May 19, 1983, the Copyright Office discussed in general terms a few alternate modes for protecting semiconductor chips designs. The Office noted the existence of patent protection in a few cases, and discussed specially tailored protection under design-copyright or misappropriation principles. Since then, in response to a request for technical assistance from a Senator's Office, the Copyright Office prepared an adaptation of the proposed Design Protection Act of 1983,[40] limiting the proposal solely to designs for semiconductor chip products. A copy of the draft design bill is attached as Appendix C.

A. Basic Features

Under a design approach, Congress would establish a new form of legal protection for the design of semiconductor chip products in a separate, independent Chapter of title 17 of the U.S. Code. Protection would be accorded designs under a standard of originality similar to that of the Copyright Act. Staple or commonplace designs would not be protected, but novelty would not be required.

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39. Title II of S. 22, 94th Cong., 1st Sess. (1975).

40. The "Design Protection Act of 1983," H.R. 2985, 97th Cong., 1st Sess. (1983).

This approach confronts directly the utilitarian nature of semiconductor chips and masks, but would nevertheless accord protection for the skill, labor, and investment employed in developing original designs.

The constitutional basis, though unstated, would be the Patent-Copyright Clause of the Constitution.

The definition of "semiconductor chip product" is taken from H.R. 1028, but the troublesome Clause (3) reference to "discovery" is eliminated.

The exclusive rights conferred would be: to make, have made, or import for sale or for use in trade, and to sell or distribute for sale or for use in trade, the chip product embodying the protected design. These rights appear similar to those proposed in H.R. 1028.

The semiconductor chip design bill contains an innocent infringer provision but omits a compulsory license. Reverse engineering is specifically not an infringement of the protected design.

Protection would endure for 10 years from the date the design is registered or first made public, whichever occurs first. Protection would be accorded only prospectively.

The registration system is simplified, in recognition of the fact that virtually all designs submitted for registration, would be registered. The certificate of registration would constitute prima facie evidence of the facts stated but not of the validity of the protected design per se. Registration would be mandatory within two years of making the design public, which provides an incentive to disclose chip designs for the benefit of the public. There would be no examination of the prior art but a defendant in an infringement action could cite the prior art, and shift the burden of proof back to the plaintiff.

The civil remedies are comparable to those of the Copyright Act; no provision has been made for criminal infringement. Penalties for false marking, fraud, and false representation are included.

B. Comparison of the Copyright and Design Approaches

1. Summary of the advantages of the design approach. The Copyright Office suggests the following as the advantages of a design approach:

a. establishes a specially tailored scheme of protection for the design of a semiconductor chip, avoiding all of the problems of fitting traditional copyright policies and principles to the previously unprotected useful article;

b. avoids the technical and substantive problems discussed earlier in this statement;

c. deals specifically with the useful article issue;

d. insulates other works fixed in semiconductor material, such as computer programs, from the restrictive provisions of H.R. 1028 (e.g., from the shorter term and the compulsory license);

e. contains a specific definition of design of semiconductor chip product, thereby avoiding the murky concepts of "mask work" and "images" of a mask work;

f. obviates the need to try to determine when and if a mask work or selected images of such a work are indeed to be considered "copies" for the purposes of the Copyright Act of 1976; and

g. by establishing a separate legislative scheme for designs of this one type of useful article, avoids granting copyright protection under the 1976 Act to this one article, while denying protection to all other designs of useful articles.

2. Common problems. The following problem areas are common to both approaches:

a. it is not clear how this new type of work will be protected internationally, regardless of whether it is labeled a design or a mask work;

b. both approaches turn on the issue of whether this new work is a "writing", although the design approach appears to finesse the constitutional problem;

c. since the semiconductor chip industry expressed a preference for legislation that would allow them to continue to reverse engineer following the 1979 hearing, either bill would have to provide for some innocent infringer/-reverse engineering type provision(s);

3. Detailed comparison

a. General approach and definitional problems. The focal point of the protection provided under H.R. 1028 is not precise.

Does a "mask work" actually exist in cases where no mask is used in the manufacturing process?

There is also a basic question concerning the extent of protection under the new exclusive rights. What does it mean for an owner of copyright in a "mask work" to have the right to authorize the substantial reproduction of "an image" of a mask work? Is an image the same as the pattern of a single layer, or possibly a substantially similar copy of such a pattern? Or, does it mean that it is possible to trace a particular configuration of a layer of part of a semiconductor chip product to its description in a schematic data base or some other representation?

The proposed extension of copyright to select images(s) of a mask work embodied in a semicondutor chip product would presumably protect some, but not all original design features of the product. In any event, the protection provided in H.R. 1028 for certain aspects of the surface of layers of a semiconductor chip product would mark a serious departure from the current protection afforded designs of useful articles. The bill would afford copyright protection to this category of designs where both the design and the article in which it is embodied may be considered useful articles, and where the design may not possess any features that can be identified separately from, and are capable of existing independently of, the utilitarian aspects of the semiconductor chip product in which an image of the design is reproduced.

Instead of introducing such confusing terms as "mask work" and "an image of a mask work" as subject matter of copyright, under a design approach, the law would specifically protect the features of shape, pattern or configuration of the surface of the layers of semiconductor chip products. There would be no question of protecting the electrical components as such. Protection for a design of semiconductor chip products would be available even though the design has an intrinsic utilitarian function that is not merely to portray its own appearance or to convey information. The Copyright Office believes that a design approach would be a more effective way to protect this particular type of industrial design.

b. Clear distinction between different protected works.

With respect to copyrighted works, such as computer programs, that may be fixed in a semiconductor chip product, the design bill clearly provides that: "Nothing . . . shall affect any right or remedy now or hereafter held by any person under chapters 1 through 8 of this title [the Copyright Act of 1976], subject to the provisions of section 113 of this title." A clear distinction is possible since different laws would be involved.

c. The "copies" problem.

Section 2 of H.R. 1028 provides that: "As used in sections 109(a), 401, 405, 501(a), 503, 506, 509, and 602 of this title, 'copy' includes a semiconductor chip product that is subject to the exclusive rights described in section 106." As noted previously, this provision raises serious questions about the applicability of those sections of the 1976 Act that are not listed, but that include the word "copy". No such problem arises in connection with the design approach. Protection would be separate from the 1976 Act. There would be no need to refer back to sections of chapters 1 through 8 of title 17 U.S.C. in order to ascertain the scope of protection for designs of semiconductor chip products.

d. Reverse engineering and fair use.

Section 908(b) of the draft design bill would allow limited use of the chip design "for the purpose of teaching, analysis, or evaluation" (reverse engineering provision). Since the bill is independent of chapters 1 through 8 of title 17 U.S.C., however, no confusion arises regarding "fair use," and no reference to section 107 is required.

e. Innocent infringement.

H.R. 1028 would establish a compulsory license subject to specific terms and conditions. The proposed design bill has no such compulsory license. Its innocent infringer provision would shift the emphasis from the ultimate consumer of a semiconductor chip product to the initial infringer. Under 908(a) of the proposed design bill, a seller or distributor of a semiconductor chip product who did not make or import the product would be deemed an infringer only if he or she induced or acted in collusion with a manufacturer to make, or an importer to import, infringing products; or where, upon the request of the proprietor of the design, they did not disclose the source of the products, and ordered or reordered such products after receiving appropriate notice of the protection subsisting in the chip design.

f. Retroactivity.

The design bill clearly would have no retroactive effect. The Copyright Office believes non-retroactivity is a fair policy and avoids the otherwise necessary inclusion of complicated "savings clauses."

VIII. CONCLUSION

In conclusion, while the Office fully supports the general proposal to protect the innovators of semiconductor chips, we tend to believe that a better system of protection could be achieved under a design approach. If the Subcommittee decides to legislate protection under traditional copyright, the Office will be happy to work with the Subcommittee in correcting the problems with the pending bill.

Thank you. I will be pleased to respond to any questions.

APPENDIX A

A SUMMARY COMPARISON OF H.R. 1028; S. 1201, AS REPORTED BY SENATE SUBCOMMITTEE; AND THE DESIGN APPROACH

H.R. 1028	S. 1201, as reported by Senate Subcommittee	Design Approach
1. Amends Copyright Act	Amends Copyright Act	Creates new form of legal protection in separate, independent Chapter 9 of title 17 U.S. Code
2. Specific work protected: "mask works" — new subject matter of copyright	Same provision as H.R. 1028	Design of semiconductor chip product
3. Standard of protectability: "original works of authorship;" must meet same standard as other copyrightable subject matter	Same provision as H.R. 1028	Original — not staple or commonplace; or varies only in insignificant details or features from designs used in the semiconductor industry
4. Constitutional basis: specific declaration that chip product may be <u>either</u> a writing or a discovery, or the manufacture, use, or distribution of which is in or affects commerce no comparable statement <u>re</u> "mask work" (Note that there is a conflict between the reference to "discovery" and the prohibition against protection for a "discovery" in 17 U.S.C. 102(b))	Same provision as H.R. 1028, except reference to "a discovery" deleted.	No declaration of constitutional basis; legislative history could state it is enacted under the power of Article I, Section 8, Clause 8

	H.R. 1028	S. 1201, as reported by Senate Subcommittee	Design Approach
5.	Definitions:		
	Definitions of "semiconductor chip product," "mask work," and "mask"	Same provision as H.R. 1028	Same definition of semiconductor chip product except Clause (3) is dropped; also defined are "design of semiconductor chip product" and "original"
	Many definitions of 17 U.S.C. 101, do not apply; the bill lists only 9 sections of 17 U.S.C. in which "copy" includes a semiconductor chip product; section 101, in which copy is defined, is not one of the nine	Same as H.R. 1028 in substance	
6.	Exclusive rights:		
	New rights to embody the mask work in a mask and to distribute a mask embodying the mask work; to use a mask embodying the mask work to make a chip product; in the manufacture of a chip product, substantially to reproduce images of the mask work on material intended to be a part of the chip product; and to distribute or use a chip product embodying the mask work or in whose manufacture images of the mask work were substantially reproduced on material intended to be part of the chip product	New rights to embody the mask work in a mask and to distribute a mask embodying the mask work; to embody an image of the mask work in a chip product; in the manufacture of a chip product, substantially to reproduce an image of the mask work on material intended to be a part of the chip product; and to distribute a chip product embodying an image of the mask work or in whose manufacture an image of the mask work was substantially reproduced on material intended to be a part of the chip product. "Use" right provided in H.R. 1028 eliminated	To make, have made, or import for sale or for use in trade, and to sell or distribute for sale or for use in trade — the chip product embodying the protected design

H.R. 1028	S. 1201, as reported by Senate Subcommittee	Design Approach
7. Reverse engineering:		
No reverse engineering provision (Note: Representative Edwards' detailed analysis of H.R. 1028 appearing at 129 Congressional Record H-645 (February 24, 1983) makes clear that the original intent of the bill's sponsors was not to interfere with use of a chip for reverse engineering) "Fair use" provision in 17 U.S.C. 107 may apply	Specific provision that reverse engineering is not infringement No apparent exclusion of "fair use" provision in 17 U.S.C. 107	Similar provision to Senate Subcommittee version of S. 1201
8. Compulsory license:		
Created for benefit of purchaser with no notice of infringement, who committed substantial funds to use of chip where equity requires further use privilege	No compulsory license, but substance of H.R. 1028 license included in expanded innocent infringer section	No compulsory license; <u>but see</u> innocent infringer provision
9. Duration:		
10 years from the first authorized distribution, use in a commercial product, or manufacture in commercial quantities in chips	Same provision as H.R. 1028	10 years from date the design is registered or first made public, whichever occurs first

H.R. 1028	S. 1201, as reported by Senate Subcommittee	Design Approach
10. Innocent infringement:		
good faith purchaser of chip product without notice of infringement is not liable for distribution of chip products before notice of infringement	Thrust of innocent infringer provision is generally similar to that in H.R. 1028. A detailed section limiting remedies available against "innocent purchasers" is included in S. 1201 in lieu of H.R. 1028's compulsory license provision	Not an infringement to make, have made, import, sell, or distribute chip product created without knowledge of, and copying from, protected design
Query liability for infringing acts other than distribution		Seller or distributor who did not make or import chip product can be an infringer only if person induced or acted in collusion with infringer, or refused to disclose source and ordered or reordered after receiving notice by registered or certified mail of the protected design
11. Remedies:		
Existing remedies of the Copyright Act	Existing remedies of the Copyright Act, except for limitations or remedies in case of innocent purchaser without notice of infringement	Comparable civil remedies; no general criminal infringement penalty; comparable remedies for false marking, fraud, and false representation
12. Effective date:		
Effective 90 days after date of enactment but specifically does not apply to chips or masks manufactured in or imported into the U.S. before the effective date; or chips manufactured in the U.S. by means of masks made in or imported into the U.S. before the effective date	Generally effective upon enactment, subject to a savings clause.	January 1, 1984

H.R. 1028	S. 1201, as reported by Senate Subcommittee	Design Approach
13. Retroactivity: Confused; some protection awarded for mask works created before enactment	Uncertain scope -- apparent intent to protect mask works whenever created or commercially distributed, except particular infringers not liable (i) for infringing conduct occurring before date of enactment, or (ii) for infringement at any time if copying was first undertaken before January 1, 1980	No retroactive effect; chip designs made public prior to effective date are not protected
14. Relationship to other works: No provision addresses the relationship of copyright in the mask work to other works	Special provision that copyright in mask work shall neither extend to, nor affect, limit, or impair any copyright in other works of authorship	Unnecessary, since not part of the Copyright Act; however, SEC. 927 does contain a general "shall not affect any right or remedy under the Copyright Act" clause
15. Adaptations; derivative works: query application of 17 U.S.C. 103. Not clear how right to make or control making of derivative works is treated or how it interrelates with reverse engineering provision	Similar to H.R. 1028	Similar provision to that in the Copyright Act
16. Notice formality: Perhaps standard Copyright Act provision applies	Perhaps standard Copyright Act provision applies	Comparable provision but uses words "Protected Design," abbreviation "Prot'd. Des.," or letter "D" in a circle

	H.R. 1028	S. 1201, as reported by Senate Subcommittee	Design Approach
17.	Omission of notice:		
	Preserve copyright by registration before or within five years of publication and add notice to U.S. distributed copies (if notice formality applies)	Same provision as H.R. 1028	Must register within two years after design made public in any case No loss of protection
	Possible loss of remedies against infringers	Same provision as H.R. 1028	Comparable provision re innocent infringers
18.	Registration system:		
	No examination of prior art; examination for copyrightable subject matter and compliance with legal and formal requirements	Same provision as H.R. 1028	Simplified system No examination of prior art (but defendant in infringement action may cite prior art and plaintiff then has burden of proving originality)
	Registration optional but prerequisite to infringement action; query appropriate deposit since chip products not a copy	Same provision as H.R. 1028	Registration is mandatory within two years of making the design public
	Certificate of registration is prima facie evidence of the validity of the copyright, if registration is timely made	Same provision as H.R. 1028	Certificate of registration is prima facie evidence of the facts
19.	Fees:		
	10 dollars	Same provision as H.R. 1028	25 dollars

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APPENDIX B

S. 1201, as reported by Senate Subcommittee

S.L.C.

SUBCOMMITTEE DRAFT
(Print reflects changes proposed by the Subcommittee) [to 11/8/83]

98th CONGRESS
1st Session

S. 1201

To amend title 17 of the United States Code to protect semiconductor chips and masks against unauthorized duplication, and for other purposes.

IN THE SENATE OF THE UNITED STATES

Mr. Mathias (for himself, Mr. Hart, and Mr. DeConcini) introduced the following bill; which was read twice and referred to the Committee on the Judiciary

[Omit the part struck through and insert the part printed in italic]

A BILL

To amend title 17 of the United States Code to protect semiconductor chips and masks against unauthorized duplication, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the ''Semiconductor Chip Protection Act of 1983''.

DEFINITIONS

Sec. 2. Section 101 of title 17 of the United States Code is amended by adding at the end thereof the following:

''A 'semiconductor chip product' is the final or intermediate form of a product--

''(1) having two or more layers of metallic, insulating, or semiconductor material, ~~deposited on or etched away~~ *deposited or otherwise placed on, or etched away or otherwise removed* from a piece of semiconductor material in accordance with a predetermined pattern;

''(2) intended to perform electronic circuitry functions; and

''(3) that is a writing ~~or-a-discovery~~, or the manufacture, use, or distribution of which is in or affects commerce.

''A 'mask work' is a series of related images, however fixed or encoded--

''(1) having the predetermined, three-dimensional pattern of metallic, insulating, or semiconductor material present or removed from the layers of a semiconductor chip product; and

''(2) in which series the relation of the images to one another is that each image has the pattern of the surface of one form of the semiconductor chip product.

''A 'mask' is a substantially two-dimensional sheet, partially transparent and partially opaque ~~sheet.~~ to preselected radiation. A mask embodies a mask work if the pattern of transparent and opaque portions of the mask is substantially similar to the pattern of one of the images of the mask work. Masks and mask works shall not be deemed pictorial, graphic, or sculptural works. The copyright in a ~~mask-or~~ mask work shall ~~not~~ neither extend to, nor affect, limit, or impair any copyright in any other work of authorship embodied therein or in a semiconductor chip product.

''~~As-used-in~~ The provisions of sections 109 (a), 901, 905, 906, 501 (A), 503, 506, 509, and 602 of this title; applicable to copies of a work shall apply also to semiconductor chip products ~~'copy'-includes-a-semiconductor chip-product-that-is-subject-to-the-exclusive-rights described-in-section-906.~~''.

SUBJECT MATTER OF COPYRIGHT

Sec. 3. Section 102 (a) of title 17 of the United States Code is amended--

(1) by adding after paragraph (5) the following:

''(6) mask works;''; and

(2) by redesignating paragraphs (6) and (7) as paragraphs (7) and (8), respectively.

EXCLUSIVE RIGHTS

Sec. 4. Section 106 of title 17 of the United States Code is amended--

(1) by striking out ''and'' at the end of paragraph (4);

(2) by striking out the period at the end of paragraph (5) and inserting ''; and'' in lieu thereof; and

(3) adding at the end thereof the following:

''(6) in the case of mask works, only the following rights--

''(A) to embody the mask work in a mask;

''(B) to distribute a mask embodying the mask work;

''(C) to ~~use a mask embodying~~ embody an image of the mask work ~~to make~~ in a semiconductor chip product;

''(D) in the manufacture of a semiconductor chip product, substantially to reproduce, by optical, electronic, or other means, ~~images~~ an image of the mask work on material intended to be part of the semiconductor chip product; and

''(E) to distribute ~~or use~~ a semiconductor chip product made as described in subparagraph (C) or (D) of this paragraph.''.

LIMITATION ON EXCLUSIVE RIGHTS AS TO MASKS

Sec. 5. (a) Chapter 1 of title 17 of the United States

Code is amended by adding at the end the following:

''§ 119. Scope of exclusive rights: ~~Compulsory licensing~~ Right of reverse engineering with respect to mask works

''(a) In the case of mask works, the exclusive rights provided by section 106 are subject to ~~compulsory licensing~~ a right of reverse engineering use under the conditions specified by this section.

~~''(b) The owner of a copyright on a mask work shall be required to grant a compulsory license under the copyright, to any applicant therefor, subject to all of the following terms and conditions, and all of the following circumstances:~~

~~''(1) The applicant has purchased a semiconductor chip product made or distributed in violation of the owner's exclusive rights under section 106,~~

~~''(2) When the applicant first purchased such semiconductor chip product (hereinafter in this section referred to as the 'infringing product'), the applicant did not have actual knowledge that or reasonable grounds to believe that the infringing product was an infringing product (hereinafter in this section referred to as 'having notice of infringement'),~~

~~''(3) The applicant, before having notice of infringement, committed substantial funds to the use of the infringing product, the applicant would suffer substantial out-of-pocket losses (other than the difference in price between the infringing product and a noninfringing product) if denied the use of the infringing product, and it would be inequitable in the circumstances not to permit the applicant to continue the use or proposed use of the infringing product,~~

~~''(4) The applicant offers, subject to the applicant's rights, if any, under section 501(e) of this title, to pay the copyright owner a reasonable royalty~~

~~for infringing products;~~

~~''(5) The royalty shall be for each unit of the infringing product distributed or used by the applicant after having notice of infringement;~~

~~''(6) The license shall be one to make and have made (but only if the copyright owner and the owner's licensees, if any, are unable to supply the applicant at a reasonable price), use, and distribute the infringing product, for substantially the same purposes that gave rise to the applicant's right to a compulsory license, throughout the United States, for the life of the copyright, revocable only for failure to make timely payments of royalties.''~~

''(h) It is not infringement of the rights of the owner of a copyright in a mask work to reproduce the pattern in one or more masks or in a semiconductor chip product solely for the purpose of teaching, analyzing, or evaluating the concepts or techniques embodied in the mask or semiconductor chip product, or the circuit schematic, logic flow, or organization of components utilized therein.''.

(b) The chapter analysis for chapter 1 of title 17 is amended by adding at the end thereof the following:

''115. Scope of exclusive rights: ~~Compulsory licensing~~ Right of reverse engineering with respect to mask works.''.

(c) Section 106 of Title 17 of the United States Code is amended by striking out ''118'' and inserting in lieu thereof ''119''.

DURATION OF COPYRIGHT

Sec. 6. Section 302 of title 17 of the United States Code is amended by adding at the end thereof the following:

''(f) Masks.--Copyright in mask works endures for a term of ten years from the earliest of first authorized--

''(1) distribution;

''(2) use in a commercial product; or

''(3) manufacture in commercial quantities of semiconductor chip products made as described in subparagraph (C) or (D) of paragraph (6) of section 106.''.

INNOCENT INFRINGEMENT

Sec. 7. ~~Section-504~~ (a) Chapter 5 of title 17 of the United States Code is amended by adding at the end thereof the following:

''§ 511. Innocent infringement of mask works

~~''(e)~~ (a) Notwithstanding any other provision of this chapter, ~~a~~ an innocent purchaser of ~~a~~ an allegedly infringing semiconductor chip product ~~who-purchased-it-in-good-faith, without-having-notice-of-infringement-(as-that-term-is-used in-section-449-of-this-title),~~ shall not be liable as an infringer or otherwise be liable or subject to remedies under this chapter with respect to the ~~use-or~~ distribution of units of such semiconductor chip product that occurred before such innocent purchaser had notice of infringement.~~'',~~

''(b) The remedies of the owner of a copyright on a mask work against an innocent purchaser shall be limited to a reasonable royalty upon each unit of the allegedly infringing semiconductor chip product that the innocent purchaser made or distributed after having notice of infringement, if the innocent purchaser establishes the applicability of all of the following circumstances:

''(1) the innocent purchaser, before first having notice of infringement, committed substantial funds to the use of the allegedly infringing product;

''(2) the innocent purchaser would suffer substantial out-of-pocket losses (other than the difference in price between the allegedly infringing product and a noninfringing product) if denied the use of the allegedly infringing product;

''(3) the innocent purchaser's use of the allegedly infringing product is and will be for substantially the same purpose that initially gave rise to the innocent purchaser's immunity under subsection (a);

''(4) in the case of an innocent purchaser who, after having notice of infringement, makes the allegedly infringing semiconductor chip product, or has it made for him, the copyright owner and the owner's licensees, if any, are unable to supply the allegedly infringing semiconductor chip product to the innocent purchaser at a reasonable price; and

''(5) it would be inequitable in the circumstances not to permit the innocent purchaser to continue the use or proposed use of the infringing product.

''(c) The immunity of an innocent purchaser and limitation of remedies with respect thereto shall extend to good faith purchasers from him.

''(d) For the purposes of this section--

''(1) 'innocent purchaser' means one who purchases an allegedly infringing semiconductor chip product in good faith, and without having notice of infringement;

''(2) 'notice of infringement' means actual knowledge that, or reasonable grounds to believe that, a product is an infringing semiconductor chip product; and

''(3) 'infringing semiconductor chip product' means a semiconductor chip product which is made or distributed in violation of the exclusive rights of an owner of a copyright in a mask work.''.

(b) The table of sections for chapter 5 is amended by adding at the end thereof the following new item:

''511. Innocent infringement of mask works.''.

IMPOUNDING AND SEIZURE

Sec. 8. Sections 503 (a), 503 (b), and 509 (a) of title 17 of the United States Code are each amended by inserting ''masks,'' after ''film negatives,'' each place it appears.

~~EFFECTIVE DATE~~

~~Sec. 9. The amendments made by this Act shall take effect ninety days after the date of enactment of this Act, but shall not apply to—~~

~~(1) semiconductor chip products manufactured in the United States or imported into the United States before the effective date;~~

~~(2) masks made in the United States or imported into the United States before the effective date; or~~

~~(3) semiconductor chip products manufactured in the United States by means of masks described in paragraph (2) of this section.~~

SAVINGS CLAUSES

Sec. 9. Nothing contained in this Act shall be deemed to add to or detract from existing rights of owners of copyrights in works of authorship listed in section 102 (a) of title 17 of the United States Code, prior to its amendment by this Act. Nothing contained in this Act shall be deemed to detract from any right of the lawful owner of a product purchased from the copyright owner, or from a person authorized by the copyright owner, freely to use, distribute, and resell the product without liability therefor under the copyright laws.

EFFECTIVE DATE

Sec. 10. The amendments made by this Act shall not create liability for any conduct that occurred prior to the date of enactment of this Act, but shall apply to all acts of manufacture or distribution of semiconductor chip products that occur in the United States after such date, to all acts of importation of semiconductor chip products into the United States that occur after such date, and to all other violations of the exclusive rights of the copyrights owner under section 106 (6) of title 17, United States Code, as amended by section 4 of this Act, that occur after such date.

Notwithstanding the provisions of this section, no alleged infringer shall be liable under this Act with respect to the continued manufacture or distribution of any semiconductor chip product that the alleged infringer commercially distributed in the United States prior to January 1, 1984.

APPENDIX C

I

98TH CONGRESS
1ST SESSION
~~H. R. 2985~~

To amend ~~the copyright law;~~ title 17 of the United States Code, to provide ~~for protection of ornamental designs of useful articles.~~ for original designs of semiconductor chip products.

IN THE ~~HOUSE OF REPRESENTATIVES~~

~~May 11, 1983~~

~~Mr. Moorhead introduced the following bill; which was referred to the Committee on the Judiciary~~

A BILL

To amend ~~the copyright law~~, title 17 of the United States Code, to provide ~~for~~ protection ~~of ornamental designs of useful articles.~~ for original designs of semiconductor chip products.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. Title 17, United States Code, is amended by adding at the end thereof the following new chapter:

"CHAPTER 9—PROTECTION ~~OF ORNAMENTAL DESIGNS OF USEFUL ARTICLES~~ FOR ORIGINAL DESIGNS OF SEMICONDUCTOR CHIP PRODUCTS

CHIP DESIGNS PROTECTED
"~~DESIGNS PROTECTED~~

"SEC. 901. (a) The author or other proprietor of an original design of a semiconductor chip product ~~ornamental design of a useful article~~ may secure the protection provided by this chapter upon complying with and subject to the provisions hereof.

"(b) For the purposes of this chapter—

"A 'semiconductor chip product' is the final or intermediate form of a product --

"(1) having two or more layers of metallic, insulating, or semiconductor material, deposited on or etched away from a piece of semiconductor material in accordance with a predetermined pattern; and

"(2) intended to perform electronic circuitry functions.

"The 'design of a semiconductor chip product', hereinafter referred to as a 'chip design', means the three-dimensional features of shape, pattern, or configuration of the surface of the layers of a semiconductor chip product. To be protected under this chapter, a chip design must be fixed in a semiconductor chip product from which it can be perceived, reproduced, or otherwise communicated either directly or with the aid of a machine or device.

"A chip design is 'original' if it is the independent creation of an author who did not copy it from another source.

"CHIP DESIGNS NOT SUBJECT TO PROTECTION

"Sec. 902.(a) Protection under this chapter shall not be available for a chip design that is--

"(1) not original;

"(2) staple or commonplace, such as a standard geometric figure or other shape, pattern or configuration which has become common, prevalent, or ordinary; or

"(3) different from a chip design excluded by subsection (2) only in insignificant details or in features which are variants commonly used in the semiconductor industry.

"(b) Protection shall be available under this chapter for an original chip design having an intrinsic utilitarian function that is not merely to portray its own appearance or to convey information: Provided, That in no case does protection for a chip design extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated or embodied in the chip design.

"REVISIONS, ADAPTATIONS, AND REARRANGEMENTS

"Sec. 903. Protection for a chip design under this chapter shall be available notwithstanding the employment in the design of a preexisting chip design, if the new design is a substantial revision, adaptation, or rearrangement of the preexisting design: Provided, That the preexisting protected design is employed with the consent of the proprietor thereof. Such protection shall be independent of any subsisting protection in material employed in the new design, and shall not be construed as securing any right to a chip design excluded from protection or as extending any subsisting protection.

"COMMENCEMENT OF PROTECTION

"Sec. 904. The protection provided for a chip design under this chapter shall commence upon the date of registration pursuant to section 912(a), or the date the design is first made public as defined by section 909(b), whichever occurs first.

~~design is first made public as defined by section 909(b), whichever occurs first.~~

"TERM OF PROTECTION

"SEC. 905. (a) Subject to the provisions of this chapter, the protection herein provided for a chip design ~~design~~ shall continue for a term of ten years from the date of the commencement of protection as provided in section 904.

"(b) Upon expiration or termination of protection in a particular chip design ~~design~~ as provided in this chapter all rights under this chapter in said design shall terminate, regardless of the number of different objects ~~articles~~ in which the design may have been utilized during the term of its protection.

"NOTICE OF CHIP DESIGN

~~"THE DESIGN NOTICE~~

"SEC. 906. (a) Whenever any chip design ~~design~~ for which protection is sought under this chapter is made public as provided in section 909(b), the proprietor shall, subject to the provisions of section 907, mark it or have it marked legibly with a notice of chip design ~~design notice~~ consisting of the following three elements:

"(1) the words 'Protected Design', the abbreviation 'Prot'd Des.', or the letter 'D' with a circle thus Ⓓ;

"(2) the year of the date on which protection for the design commenced; and

"(3) the name of the proprietor, an abbreviation by which the name can be recognized, or a generally accepted alternative designation of the proprietor; any distinctive identification of the proprietor may be used if it has been approved and recorded by the ~~Adminis-~~ Register of Copyrights, trator before the ~~design~~ chip design marked with such identification is registered.

After registration the registration number may be used instead of the elements specified in (2) and (3) hereof.

"(b) The notice shall be so located and applied as to give reasonable notice of design protection while the ~~useful article~~ semiconductor chip product embodying the design is passing through its normal channels of commerce. ~~This requirement may be fulfilled, in the case of sheetlike or strip materials bearing repetitive or continuous designs, by application of the notice to each repetition, or to the margin, selvage, or reverse side of the material at reasonably frequent intervals, or to tags or labels affixed to the material at such intervals.~~

"(c) When the proprietor of a ~~design~~ chip design has complied with the provisions of this section, protection under this chapter shall not be affected by the removal, destruction, or obliteration by others, without the authorization of the proprietor of the design, of the ~~design notice on an article.~~ notice of chip design on a semiconductor chip product.

"EFFECT OF OMISSION OF NOTICE

"SEC. 907. The omission of the notice prescribed in section 906 shall not cause loss of the protection or prevent recovery for infringement against any person who, after written notice of the ~~design~~ chip design protection, begins an undertaking leading to infringement: *Provided*, That such omission shall prevent any recovery under section 922 against a person who began an undertaking leading to infringement before receiving written notice of the ~~design~~ chip design protection, and no injunction shall be had unless the proprietor of the design shall reimburse said person for any reasonable expenditure or contractual obligation in connection with such undertaking incurred before written notice of ~~design~~ chip design protection, as the court in its discretion shall direct. The burden of providing written notice shall be on the proprietor.

"INFRINGEMENT

"SEC. 908. (a) It shall be infringement of a ~~design protection~~ chip design protected under this chapter for any person, without the consent of the proprietor of the design, within the United States or its territories or possessions and during the term of such protection, to—

"(1) make, have made, or import, for sale or for use in trade, any infringing ~~article~~ semiconductor chip product as defined in subsection (d) hereof; or

"(2) sell or distribute for sale or for use in trade any such ~~infringement article~~ infringing semiconductor chip product: *Provided, however*, That a seller or distributor of any such ~~article~~ product who did not make or import the same shall be deemed to be an infringer only if—

"(i) he he or she induced or acted in collusion with a manufacturer to make, or an importer to import such ~~article~~ product (merely purchasing or giving an order to purchase in the ordinary course of business shall not of itself constitute such inducement or collusion); or

"(ii) he he or she refuses or fails upon the request of the proprietor of the ~~design~~ chip design to make a prompt and full disclosure of his source of such ~~article,~~ product, and he orders or reorders such ~~article~~ product after having received notice by registered or certified mail of the protection subsisting in the ~~design.~~ chip design.

"(b) It shall not be infringement to make, have made, import, sell, or distribute, any ~~article embodying a~~ semiconductor chip product embodying a chip design created without knowledge of, and copying from, a protected design. It shall also not be an infringement to make a copy of a protected design solely for the purpose of teaching, analysis, or evaluation.

"(c) A person who incorporates into his own product of manufacture an infringing ~~article~~ semiconductor chip product acquired from others in the ordinary course of business, or who, without knowledge of the protected ~~design,~~ chip design, makes or processes an infringing ~~article~~ semiconductor chip product for the account of another person in the ordinary course of business, shall not be deemed an infringer except under the conditions of clauses (i) and (ii) of paragraph (a)(2) of this section. Accepting an order or reorder from the source of the infringing ~~article~~ semiconductor chip product shall be deemed ordering or reordering within the meaning of clause (ii) of paragraph (a)(2) of this section.

"(d) An 'infringing ~~article~~ semiconductor chip product' as used herein is any ~~article,~~ product the design of which has been copied from the protected ~~design,~~ chip design, without the consent of the proprietor: ~~*Provided, however,* That an illustration or picture of a protected design in an advertisement, book, periodical, newspaper, photograph, broadcast, motion picture, or similar medium shall not be deemed to be an infringing article. An article~~ A semiconductor chip product is not an infringing ~~article~~ product if it embodies, in common with the protected design, only elements described in ~~subsections (a) through (d) of section 902,~~ subsections (1) through (3) of section 902(a).

"(e) The party alleging rights in a ~~design~~ chip design in any action or proceeding shall have the burden of affirmatively establishing its originality whenever the opposing party introduces an earlier work which is identical to such design, or so similar as to make a prima facie showing that such design was copied from such work.

"APPLICATION FOR REGISTRATION

"SEC. 909. (a) Protection under this chapter shall be lost if application for registration of the ~~design~~ chip design is not made within ~~six months~~ two years after the date on which the design was first made public.

"(b) A chip design is made public when, by the proprietor of the design or with his consent, an existing ~~useful article~~ semiconductor chip product embodying the design is anywhere publicly exhibited, publicly distributed, or offered for sale or sold to the public.

"(c) Application for registration ~~or renewal~~ may be made by the proprietor of the ~~design.~~ chip design.

"(d) The application for registration shall be made to the Register of Copyrights ~~Administrator~~ and shall state (1) the name and address of the author or authors of the chip design ~~design~~; (2) the name and address of the proprietor if different from the author; (3) a general description of the features of the layers of a semiconductor chip product for which protection is claimed; ~~the specific name of the article, indicating its utility~~; (4) the date, if any, that the chip design ~~design~~ was first made public, if such date was earlier than the date of application; (5) affirmation that the chip design ~~design~~ has been fixed in a semiconductor chip product ~~useful article~~; and (6) such other information as may be required by the Register. ~~Administrator. The application for registration may include a description setting forth the salient features of the design, but the absence of such a description shall not prevent registration under this chapter.~~

"(e) The application for registration shall be accompanied by a written declaration, in accordance with 18 U.S.C. 1001, ~~statement under oath~~ by the applicant or his duly authorized agent or representative, setting forth that, to the best of his knowledge and belief (1) the chip design ~~design~~ is original and was created by the author or authors named in the application; (2) the chip design ~~design~~ has not previously been registered on behalf of the applicant or his predecessor in title; and (3) the applicant is the person entitled to protection and to registration under this chapter. If the chip design ~~design~~ has been made public

of chip design
with the ~~design~~ notice prescribed in section 906, the statement shall also describe the exact form and position of the ~~design notice.~~ notice.

~~"(f) Error in any statement or assertion as to the utility of the article named in the application, the design of which is sought to be registered shall not affect the protection secured under this chapter.~~

"(f)
"~~(g)~~ Errors in omitting a joint author or in naming an alleged joint author shall not affect the validity of the registration, or the actual ownership or the protection of the design: *Provided*, That it is shown that the error occurred without deceptive intent. Where the ~~design~~ chip design was made within the regular scope of the author's employment and individual authorship of the design is difficult or impossible to ascribe and the application so states, the name and address of the employer for whom the design was made may be stated instead of that of the individual author.

"(g)
"~~(h)~~ The application for registration shall be accompanied by two copies of a drawing or other ~~pictorial~~ representation of ~~the features of~~ each of the layers of the semiconductor chip product for which protection is claimed. ~~tion of the useful article having one or more views, adequate~~ to show the ~~design~~ chip design, in a form and style suitable for reproduction, which shall be deemed a part of the application.

"(h)
"~~(i)~~ Where the ~~distinguishing elements of a design are in~~ original features of a chip design are in substantially the same form in a number of different ~~useful~~ semiconductor chip ~~articles, the design~~ products, the design shall be protected as to all such ~~articles~~ products

when protected as to one of them, but not more than one registration shall be required.

~~"(j) More than one design may be included in the same application under such conditions as may be prescribed by the Administrator. For each design included in an application the fee prescribed for a single design shall be paid.~~

"BENEFIT OF EARLIER FILING DATE IN FOREIGN COUNTRY

"SEC. 910. An application for registration of a ~~design~~ chip design filed in this country by any person who has, or whose legal representative or predecessor or successor in title has previously regularly filed an application for registration of the same design in a foreign country which affords similar privileges in the case of application filed in the United States or to citizens of the United States shall have the same effect as if filed in this country on the date on which the application was first filed in any such foreign country, if the application in this country is filed within six months from the earliest date on which any such foreign application was filed.

"WRITTEN DECLARATIONS

~~"OATHS AND ACKNOWLEDGMENTS~~

~~"SEC. 911. (a) Oaths and acknowledgments required by this chapter may be made before any person in the United States authorized by law to administer oaths, or, when made in a foreign country, before any diplomatic or consular officer of the United States authorized to administer oaths, or before any official authorized to administer oaths in the foreign~~

~~country concerned, whose authority shall be proved by a certificate of a diplomatic or consular officer of the United States, and shall be valid if they comply with the laws of the state or country where made.~~

"~~(b) The Administrator may by rule prescribe that any document to be filed in the Office of the Administrator and which is required by any law, rule, or other regulation to be under oath may be subscribed to by a written declaration in such form as the Administrator may prescribe, such declaration to be in lieu of the oath otherwise required.~~

~~"(c) Whenever a written declaration as permitted in subsection (b) is used, the document must warn the declarant that~~ "SEC. 911. Willful false statements and the like in written declarations required by this Chapter are punishable by fine or imprisonment, or both (18 U.S.C. 1001) and may jeopardize the validity of the application or document or a registration resulting therefrom.

"EXAMINATION OF APPLICATION AND ISSUE OR REFUSAL OF REGISTRATION

"SEC. 912. (a) Upon the filing of an application for registration in proper form as provided in section 909, and upon payment of the fee provided in section 915, the ~~Administrator~~ Register shall determine whether or not the application relates to a design which on its face appears to be subject to protection under this chapter, and if so the ~~Administrator~~ Register shall register the design. ~~Registration under this subsection shall be en-~~

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~~nounced by publication~~. The date of registration shall be the date ~~of publication~~ of receipt in the Copyright Office of the required application, copies, and fee in acceptable form.

"(b) If, in the judgment of the ~~Administrator~~ Register of Copyrights, the application for registration relates to a ~~design~~ chip design which on its face is not subject to protection under this chapter, the ~~Administrator~~ Register shall send the applicant a notice of refusal to register and the grounds therefor. Within three months from the date the notice of refusal is sent, the applicant may request, in writing, reconsideration of his application. After consideration of such a request, the ~~Administrator~~ Register shall either register the design or send the applicant a notice of final refusal to register.

~~"(c) Any person who believes he is or will be damaged by a registration under this chapter may, upon payment of the prescribed fee, apply to the Administrator at any time to cancel the registration on the ground that the design is not subject to protection under the provisions of this chapter, stating the reasons therefor. Upon receipt of an application for cancellation, the Administrator shall send the proprietor of the design, as shown in the records of the Office of the Administrator, a notice of said application, and the proprietor shall have a period of three months from the date such notice was mailed in which to present arguments in support of the validity of the registration. It shall also be within the authority of the Administrator to establish, by regulation, conditions~~

~~under which the opposing parties may appear and be heard in support of their arguments. If, after the periods provided for the presentation of arguments have expired, the Administrator determines that the applicant for cancellation has established that the design is not subject to protection under the provisions of this chapter, he shall order the registration stricken from the record. Cancellation under this subsection shall be announced by publication, and notice of the Administrator's final determination with respect to any application for cancellation shall be sent to the applicant and to the proprietor of record.~~

~~"(d) When a design has been registered under this section, the lack of utility of any article in which it has been embodied shall be no defense to an infringement action under section 920, and no ground for cancellation under subsection (c) of this section or under section 923~~.

"CERTIFICATION OF REGISTRATION

"SEC. 913. Certificates of registration shall be issued in the name of the United States ~~under the seal of the Office of the Administrator~~ by the Register of Copyrights and shall be recorded in the official records ~~of that office~~ of the Copyright Office. The certificate shall state the name or number under which the semiconductor chip product may be identified ~~of the useful article~~, the date of filing of the application, the date of registration, the date the ~~design~~ chip design was made public, if earlier than the date of filing of the application, and shall contain ~~a~~ the general description of the features of the layers of the semiconductor chip product for which protection is claimed, as ~~reproduction of the drawing or other pictorial representation~~ set forth in the application for registration.

~~showing the design. Where a description of the salient features of the design appears in the application, this description shall also appear in the certificate.~~ A certificate of registration shall be admitted in any court as prima facie evidence of the facts stated therein.

"PUBLICATION OF ANNOUNCEMENTS AND INDEXES

"Sec. 914(a) The Register of Copyrights shall provide and keep in the Copyright Office records of all registrations of chip designs, recordations and other actions taken under this chapter, and shall prepare indexes of these records. Such records and indexes shall be open to public inspection. The Register may also publish the drawing or other representation of registered chip designs for sale or other distribution.

"(b) The Register shall establish and maintain a file of the drawings or other representations of registered chip designs, which file shall be available for use by the public under such conditions as the Register may prescribe.

"FEES

"SEC. 915. (a) There shall be paid to the ~~Administrator~~ Register of Copyrights the following fees:

"(1) On filing each application for registration ~~or for renewal of registration of a design, $15.~~ of a chip design, $25.

~~"(2) For each additional related article included in one application, $15.~~

"~~(3)~~ (2) For recording an assignment, ~~$3~~ $10 for the first six pages, and for each additional ~~two~~ pages or less, $1.

"(3) ~~"(4)~~ For a certificate of correction of an error not the fault of the Office, ~~$10.~~ $15.

"(4) ~~"(5)~~ For a certification of copies of records, $4 ~~$1.~~

~~"(6) On filing each application for cancellation of a registration, $15.~~

"(b) The Register ~~Administrator~~ may establish charges for materials or services furnished by the Copyright Office ~~Office~~, not specified above, reasonably related to the cost thereof.

"REGULATIONS

"SEC. 916. The Register of Copyrights ~~Administrator~~ may establish regulations not inconsistent with law for the administration of this chapter.

"COPIES OF RECORDS

"SEC. 917. Upon payment of the prescribed fee, any person may obtain a certified copy of any official record ~~of the Office of the Administrator,~~ the Copyright Office pertaining to a chip design, which copy shall be admissible in evidence with the same effect as the original.

"CORRECTION OF ERRORS IN CERTIFICATES

"SEC. 918. The Register of Copyrights ~~Administrator~~ may correct any error in a registration incurred through the fault of the Copyright Office ~~Office~~, or, upon payment of the required fee, any error of a clerical or typographical nature not the fault of the Office occurring in good faith, by a certificate of correction ~~under seal~~. Such registration, together with the certificate, shall thereafter have the same effect as if the same had been originally issued in such corrected form.

"OWNERSHIP AND TRANSFER

"SEC. 919. (a) The property right in a ~~design~~ chip design subject to protection under this chapter shall vest in the author, the legal representatives of a deceased author or of one under legal incapacity, the employer for whom the author created the ~~design~~ chip design in the case of a design made within the regular scope of the author's employment, or a person to whom the rights of the author or of such employer have been transferred. The person or persons in whom the property right is vested shall be considered the proprietor of the ~~design~~ chip design.

"(b) The property right in a registered ~~design,~~ chip design or a design for which an application for registration has been or may be filed, may be assigned, granted, conveyed, or mortgaged by an instrument in writing, signed by the proprietor, or may be bequeathed by will.

~~"(c) An acknowledgment as provided in section 911 shall be prima facie evidence of the execution of an assignment, grant, conveyance, or mortgage.~~

"~~(d)~~ (c) An assignment, grant, conveyance, or mortgage shall be void as against any subsequent purchaser or mortgagee for a valuable consideration, without notice, unless it is recorded in the ~~Office of the Administrator~~ Copyright Office within three months from its date of execution or prior to the date of such subsequent purchase or mortgage.

"REMEDY FOR INFRINGEMENT

"SEC. 920. (a) The proprietor of a ~~design~~ chip design shall have remedy for infringement by civil action instituted after issuance of a certificate of registration of the design.

"(b) The proprietor of a ~~design~~ chip design may have judicial review of a final refusal of the ~~Administrator~~ Register of Copyrights to register the design, by a civil action brought as for infringement and shall have remedy for infringement by the same action if the court adjudges the design subject to protection under this chapter: *Provided*, That (1) he has previously duly filed and duly prosecuted to such final refusal an application in proper form for registration of the design, and (2) he causes a copy of the complaint in action to be delivered to the ~~Administrator~~ Register within ~~ten~~ twenty days after the commencement of the action, and (3) the defendant has committed acts in respect to the ~~design~~ chip design which would constitute infringement with respect to a design protected under this chapter.

"(c) The ~~Administrator~~ Register may, at his or her option, become a party to the action with respect to the issue of registrability of the design claim by entering an appearance within sixty days after such service, but the ~~Administrator's~~ Register's failure to become a party shall not deprive the court of jurisdiction to determine that issue.

"INJUNCTION

"SEC. 921. The several courts having jurisdiction of actions under this chapter may grant injunctions in accordance with the principles of equity to prevent infringement, including, in their discretion, prompt relief by temporary restraining orders and preliminary injunctions.

"RECOVERY FOR INFRINGEMENT, AND SO FORTH

"SEC. 922. (a) Upon finding for the claimant, the court shall award such claimant damages adequate to compensate for the infringement, but in no event less than the reasonable value the court shall assess them. In addition, the court may increase the damages to such amount, not exceeding $50,000 or $1 per copy, whichever is greater, as to the court shall appear to be just. The damages awarded in any of the above circumstances shall constitute compensation and not a penalty. The court may receive expert testimony as an aid to the determination of damages.

"(b) Alternatively, the court may award the claimant the infringer's profits resulting from the sale of the infrining semiconductor chip products ~~copies~~ if it finds that the infringer's sales are reasonably related to the use of the claimant's chip design ~~design~~. In such a case, the claimant shall be required to prove only the infringer's sales and the infringer shall be required to prove its expenses against such sales.

"(c) No recovery under paragraph (a) or (b) shall be had for any infringement committed more than three years prior to the filing of the complaint.

"(d) The court may award reasonable attorney's fees to the prevailing party. The court may also award other expenses of suit to a defendant prevailing in an action brought under section 920(b).

"(e) The court may order that all infringing semiconductor chip products ~~articles~~, and any masks, tapes or other means specifically adapted for fabricating ~~any plates, molds, patterns, models, or other means specifically adapted for making~~ the same be delivered up for destruction or other disposition as the court may direct.

"POWER OF COURT OVER REGISTRATION

"SEC. 923. In any action involving a chip design ~~design~~ for which protection is sought under this chapter, the court when appropriate may order registration of a design or the cancellation of a registration. Any such order shall be certified by the court to the Register ~~Administrator~~, who shall make an appropriate entry upon the record.

"LIABILITY FOR ACTION ON REGISTRATION FRAUDULENTLY OBTAINED

"SEC. 924. Any person who shall bring an action for infringement knowing that registration of the chip design ~~design~~ was obtained by a false or fraudulent representation materially affecting the rights under this chapter, shall be liable in the sum of $1,000, or such part thereof as the court may determine, as compensation to the defendent, to be charged against the plaintiff and paid to the defendant, in addition to such costs and attorney's fees of the defendant as may be assessed by the court.

"PENALTY FOR FALSE MARKING

"SEC. 925. (a) Whoever, for the purpose of deceiving the public, marks upon, or applies to, or uses in advertising in connection with any semiconductor chip product ~~article~~ made, used, distributed, or sold, the design of which is not protected under this chapter, a notice of chip design ~~design notice~~ as specified in section 906 or any other words or symbols importing that the design is protected under this chapter, knowing that the design is not so protected, shall be fined not more than $2500 ~~$500~~ for every such offense.

"(b) Any person may sue for the penalty, in which event, one-half shall go to the person suing and the other to the use of the United States.

"PENALTY FOR FALSE REPRESENTATION

"SEC. 926. Whoever knowingly makes a false representation materially affecting the rights obtainable under this chapter for the purpose of obtaining registration of a design under this chapter shall be fined not more ~~less~~ than 2500 ~~$500 and not more than $1,000~~, and any rights or privileges he may have in the chip design ~~design~~ under this chapter shall be forfeited.

"RELATION TO COPYRIGHT LAW

"SEC. 927. ~~(a)~~ (a) Nothing in this chapter shall affect any right or remedy now or hereafter held by any person under chapters 1 through 8 of this title, subject to the provisions of section 113 of this title.

"(b) References to "this title" in Chapters 1 through 8 of title 17 of the United States Code shall be understood to apply only to Chapters 1 through 8 and not to Chapter 9.

~~"(b) When a pictorial, graphic, or sculptural work in which copyright subsists under chapters 1 through 8 of this title is utilized in an original ornamental design of a useful article, by the copyright proprietor or under an express license from such proprietor, the design shall be eligible for protection under the provisions of this chapter.~~

"RELATION TO PATENT LAW

"SEC. 928. (a) Nothing in this chapter shall affect any right or remedy available to or held by any person under title 35 of the United States Code.

"(b) The issuance of a ~~design~~ patent for a chip ~~an ornamental~~ design ~~for an article of manufacture~~ under said title 35 shall terminate any protection of the design under this chapter.

"COMMON LAW AND OTHER RIGHTS UNAFFECTED

"SEC. 929. Nothing in this chapter shall annul or limit (1) common law or other rights or remedies, if any, available to or held by any person with respect to a design which has not been registered under this chapter, or (2) any trademark rights or right to be protected against unfair competition.

"REGISTER OF COPYRIGHTS

"~~ADMINISTRATOR~~

"SEC. 930. ~~The Administrator and Office of the Administrator referred to in this chapter shall be the Register of Copyrights and Library of Congress, respectively.~~

All administrative functions and duties under this chapter are the responsibility of the Register of Copyrights as director of the Copyright Office of the Library of Congress. The Register of Copyrights, together with the subordinate officers and employees of the Copyright Office, shall be appointed by the Librarian of Congress, and shall act under the Librarian's general direction and supervision.

~~SEVERABILITY CLAUSE~~

~~"SEC. 931. If any provisions of this chapter or the application of such provision to any person or circumstance is held invalid, the remainder of the chapter or the application to other persons or circumstances shall not be affected thereby.~~

"AMENDMENT OF OTHER STATUTES

"SEC. 932. Title 28 of the United States Code is amended—

"(a) by inserting 'designs,' after 'patents,' in the first sentence of section 1338(a);

"(b) by inserting ', design,' after 'patent' in the second sentence of section 1338(a);

"(c) by inserting 'design,' after 'copyright,' in section 1338(b);

"(d) by inserting 'and registered designs' after 'copyrights' in section 1400; and

"(e) by revising section 1498(a) to read as follows:

"'(a) Whenever a registered design or invention described in and covered by a patent of the United States is used or manufactured by or for the United States without license of the owner thereof or lawful right to use or manufacture the same, the owner's remedy shall be by action against the United States in the ~~Court of Claims~~ United States Claims' Court for the recovery of his reasonable and entire compensation for such use and manufacture.

"'For the purposes of this section, the use or manufacture of a registered ~~design~~ chip design or an invention described in and covered by a patent of the United States by a contractor, a subcontrator, or any person, firm, or corporation for the Government and with the authorization or consent of the Government, shall be construed as use or manufacture for the United States.

"'The court shall not award compensation under this section if the claim is based on the use or manufacture by or for the United States of any article owned, leased, used by, or in the possession of the United States, prior to, in the case of an invention, July 1, 1918, and in the case of a registered ~~design~~ chip design, July 1, 1983.

"'A Government employee shall have the right to bring suit against the Government under this section except where he was in a position to order, influence, or induce use of the registered ~~design~~ chip design or invention by the Government. This section shall not confer a right of action on any design registrant or patentee or any assignee of such ~~design~~ chip design registrant or patentee with respect to any ~~design~~ chip design created by or invention discovered or invented by a person while in the employment or service of the United States, where the ~~design~~ chip design or invention was related to the official functions of the employee, in cases in which such functions included research and development, or in the making of which Government time, materials, or facilities were used.'.

"TIME OF TAKING EFFECT

"SEC. 933. This chapter shall take effect ~~one year after enactment of this Act~~ January 1, 1984.

"NO RETROACTIVE EFFECT

"SEC. 934. Protection under this chapter shall not be available for any ~~design~~ chip design that has been made public as provided in section 909(b) prior to the effective date of this chapter.

"SHORT TITLE

"SEC. 935. This chapter may be cited as the ~~'Design~~ 'Semiconductor Chip Design' Protection Act of 1983'.".

~~SEC. 2. Title 17, United States Code, section 113, is amended by adding at the end thereof the following new subparagraph:~~

~~"(d) When a pictorial, graphic, or sculptural work in which copyright subsists under chapters 1 through 8 of this title is utilized in an original ornamental design of a useful article, by the copyright proprietor or under an express li-~~

Mr. KASTENMEIER. We thank you for the presentation. It was very, very well done.

You were asked to draft a design approach for an inquiring member of the Senate committee and you submitted that approach to the committee or to such a person?

Ms. SCHRADER. We submitted the draft design bill to the legislative aide of a Senator. We understand that the draft was passed to the industry for some review and comment and the reaction essentially was that a copyright approach is preferable. The matter of protection is one of great urgency, and there was a concern that by turning to a design approach, and looking at new language that had not been considered by the people in the semiconductor chip industry, would necessitate referring the proposal back to the industry. The industry believed this would cause a delay of several months. Also in any event, the industry prefers, a copyright approach, since they can fit the protection into an existing system that they feel would be more advantageous than a new and untried form of protection.

This is our understanding of the reasons for the rejection of the proposal.

Mr. KASTENMEIER. In any event, at this point in time, you don't have any specific acceptance of your draft in terms of the Senate's approach?

Ms. SCHRADER. No; the bill hasn't been introduced and we have no indication that there is any interest in introducing the bill in the Senate.

Mr. KASTENMEIER. One thing I do not really understand in terms of your presentation is the fact that you state, at the outset, that there is an equitable need or otherwise for protective legislation. You give a very sanguine presentation of the reasons why the design protection approach would be preferred, and then you conclude by saying, of course, you do not endorse this bill or this approach. Why do you not endorse anything?

Ms. SCHRADER. Let me clarify our position. We do tend to think the design approach is better. We think the overriding issue though is the need for protection.

Mr. KASTENMEIER. What is best as opposed to better?

Ms. SCHRADER. We think the design approach is the best for protection of the semiconductor chip products, but we have understood that there is an urgency in achieving legislation. This really is a question for Congress to decide, whether there is enough time to reflect on this new approach that has been suggested.

Mr. KASTENMEIER. Well, I was trying to determine what you mean by endorse and not endorse, your own approach, which you prefer and feel is best. I still don't understand why you do not endorse it. You are not captives of industry here. You need not worry whether or not someone else doesn't agree with your approach.

Ms. SCHRADER. That is entirely true, and we have presented the draft to this subcommittee as an appendix. Of course, we don't think that it really is our function to seek to have a Member of Congress introduce this bill, but the bill is before you and if there is interest in the legislation, it could be considered along with H.R. 1028. When I say we don't endorse the specific bill, we do endorse the design approach. We recognize that there may be a need to reflect on some of the provisions of the design bill.

What we did was simply to adapt the bill that had been introduced by Mr. Moorhead to cover useful articles in general, and we restricted it to semiconductor chip designs. It may be that there should be additional provisions specifically tailored to semiconductor chip designs. We really do not want to put the bill forward as a finished product. It is an approach that we think would be useful to consider, and design protection would be preferable to copyright.

Mr. KASTENMEIER. Whether we like it or not, would you not agree that we do in fact have a hybrid here? We have something which is not purely copyright, and not purely patent, but rather something that reflects both elements, with some of both elements?

Ms. SCHRADER. I think that is entirely true. As Mr. Mossinghoff said, there is general agreement that the protection for semiconductor chips should be predicated more closely on copyright principles than patent, especially with respect to the standard of protectability. That is, the concept of originality should be the standard, and it should be essentially the copyright principle of originality. But in the design bill, for example, there is the concept that you must register the design within 2 years of public disclosure or you lose all protection. That is more akin to the patent system than to copyright. The design approach does tend to be an amalgam of the two, but closer to the copyright.

Mr. KASTENMEIER. In terms of an approach, one witness earlier suggested we ought to distinguish, we ought to have an "industrial copyright," as opposed to design protection. What is your comment to that? Is that a useful comment or suggestion that we might have something other than a pure, classical copyright? We must have an industrial copyright or we might have a design protection? Or are we just talking about semantics?

Ms. SCHRADER. I must confess for me it is a matter of semantics as between industrial copyright and design copyright. It seems to me that they essentially are akin—that you are talking about the same principles.

Perhaps Professor Patterson would be reluctant to use the term "design" because of the belief that it may open the door to the protection of the whole panoply of designs of useful articles. There is no question that if Congress were to pass legislation using a design approach that is limited to semiconductor chips, it would be a precedent for other useful articles. I think one has to recognize that those who might wish to get protection for other useful articles would regard design protection for chips as a precedent. But protection for other useful articles could only be achieved by specific legislative decisions by the Congress, since the bill as it is now drafted, is very specific and is limited to semiconductor chip design by its terminology and by its definitions. One would have to consider in each case whether you wanted to extend protection to designs of furniture and appliances, et cetera, and I do not think it is inevitable that you would make that extension. Each industry could be analyzed to see whether there was a particular need for protection and whether protection should be accorded under something like a design semiconductor chip approach. As between industrial copyright, and design copyright, for me it is essentially the same.

In addition, Professor Patterson's comments go to the question of protection for publishers as opposed to protection for authors. Here I do not have too much sympathy for the concept, because it seems to us that what is important is protection for copyright. We believe that through contractual arrangements and if necessary, even through collective bargaining, and unions, authors, and creators are able to protect themselves and get their fair share of royalties that accrue under the copyright. The important point is to protect the property interest and leave it to contract, custom or collective bargaining as to who gets what share between publishers and authors.

Certainly, we think authors are entitled to their fair share and should be rewarded for their creations, but we think this does happen by and large through the existence of copyright.

Mr. KASTENMEIER. That raises a larger area, but let me narrow this question of approach. Among other things, you raise questions whether a chip can be called a copy and whether a mask work is a writing, and what is discovery and what is utilitarian.

Do you have any constitutional trouble with H.R. 1028 in terms of, if it were to pass, whether it is constitutionally acceptable? I gather you assume that the design approach appears to finesse any constitutional problems. I wonder if you had any reservations about any of these approaches?

Ms. SCHRADER. The design approach tends to finesse the constitutional issue in part, because there isn't any prior history. It would be a new form of protection. It is a form of protection, new for us. Of course, it is a form of protection that exists in many countries of the world, and one would think that there should be a constitutional basis for it. Presumably, the patent-copyright clause would be adequate to protect designs whether you regard them as writings or whether you regard them as some type of lesser discovery, but not rising to the level of novelty and nonobviousness.

As to the question of constitutionality of mask works, we do believe that, based on prior history and the expansion of the term "writings," if Congress decides to protect mask works under the copyright clause, it is very likely the courts will uphold this.

We have noted a technical problem with the bill because the bill defines chip products as either writings or discoveries, in terms of the patent-copyright clause, but the Copyright Act itself prohibits protection for discoveries. There is a conflict that should be corrected. The Senate has, in its subcommittee version, dropped the reference to the term "discoveries."

Mr. KASTENMEIER. One last question about term of protection. Is it generally agreed that 10 years is an appropriate term? Are there any other terms that are suggested by people who have been thinking about this problem within the last couple of years?

Ms. SCHRADER. We have not heard any specific suggestions. I think, because of the experience in 1979, it became clear that the standard term under the Copyright Act would be too long, and the industry then apparently achieved a consensus on the 10-year term. I understand Senator DeConcini perhaps made some reference in the Senate committee markup that the term should be more than 10 years. I think it may have been just a passing remark and he specified no period of years.

Mr. KASTENMEIER. Thank you.

I yield to the gentleman from Michigan.

Mr. SAWYER. You mentioned whether or not it would be extended to furniture designs and so forth. I recall a number of years ago my law firm was counsel for the Baker Furniture Co., which is a top-of-the-line furniture company. They had invested about 2 years and hundreds of thousands of dollars sending artists or furniture designers around to Asiatic museums and all over Europe to develop an Asiatic Americanized design for their furniture line. After about 2 years of design effort, they exhibited it in the furniture exhibitions, and another organization copied it precisely. They couldn't get their copies made fast enough, so they used photographs of the Baker pieces that were exhibited in their advertisements while they began production of their own.

Now, I was startled to find out when we researched it—and of course we were not copyright or patent experts, but we retained firms that were—to find there was absolutely no recourse. This was totally allowable piracy, if you will. It just seemed to me, from that time forward, that there ought to be some form of legitimate protection to encourage that art form of furniture designing, and the investment of that time, and effort, and so forth that go into the development of a line.

I am not basically a protectionist, I just think that this outright copying we saw with one of these discs a while back, which I alluded to with Mr. Mossinghoff, is something that really is discouraging progress in industry, or art, or whatever you might call it.

But I deduce from what you say that you don't significantly differ from my feeling that regardless of whether we put Professor Patterson's name of industrial copyright or some other suitable head on it, and give it the attributes of copyright—in other words, testing it against subjective originality, as opposed to objective or worldwide—that we would be better off perhaps with a separate statute under whatever name by giving it essentially a copy-type protection tailored to that particular thing in terms and whatnot?

Ms. SCHRADER. Yes; that is our view.

Mr. SAWYER. Do you have any feeling that perhaps we ought to take a look at splitting the electronic objects off from the print type as far as copyright goes?

I will tell you that has to be the most perplexing problem I have ever coped with since I have come here. I haven't heard anyone else come up with any great bill and the sunburst of how you solve that whole issue.

Ms. SCHRADER. I believe that questions concerning so-called new electronic media—satellites, cable, and so forth—relate to the scope of protection—questions of how exclusive rights should be defined and how they should be limited. I wouldn't consider those subject matter issues, whereas the pending bill does intend to add a new subject matter category to the Copyright Act, which very significantly broadens the scope of the act.

The issues concerning satellites, photocopying, cable, and electronic publishing are really new technological uses of very traditional works. You are dealing with protection of literary works, dramatic compositions, musical compositions, and so forth—works that have been protected under the Copyright Act for 150 years or more, depending on which category you are talking about.

If you try to split off these new uses in some way, it would be extremely difficult, if it is even feasible, because you still would be left with the fact that you are really trying to fashion a set of rules that govern traditional copyright subject matter. After all, in the case of cable, it is motion pictures that are being performed on cable. These motion pictures may be based on novels or dramatic plays, and may incorporate music and so forth. This traditional copyright subject matter, we believe, should be dealt with in the Copyright Act.

There are very difficult questions to wrestle with about the scope of the rights and limitations on the exclusive rights, as these new technologies develop. They can be accommodated within the framework of the traditional Copyright Act and almost have to be.

Mr. SAWYER. Somebody mentioned—I guess it was Mr. Mossinghoff—that we would lose if we went to a separate act, the additional history of copyrights. But it would seem to me—I would like to get your reaction—it seems to me that might be an advantage as opposed to a disadvantage in that we are dealing with a somewhat different animal, that really would not fit into existing copyright law as I see it.

It might be an advantage to kind of cut loose from the historical decisions under that. Do you have any feeling about that?

Ms. SCHRADER. We tend to agree, and that is one of the reasons for preferring a design approach. We tend to think that the difficulties of fitting semiconductor chips into traditional copyright and applying past court decisions, whether regarding the concept of publication, the question of what is a copy, or the exclusive rights and so forth, will be very difficult. It might be better to start with an entirely new approach and deal with the special problems of semiconductor chips in separate legislation.

Mr. SAWYER. What is your feeling about Mr. Mossinghoff's—as I got it, not necessarily objection, but inquiry on whether it would be easier to get international acceptance or an adoption by other countries of similar statutes if we kept it under the existing copyright law?

Ms. SCHRADER. It certainly is a significant point. In the Copyright Office, we do not have a definite position on this, but I would like to respond by noting that there may be some problems with a copyright approach internationally. There again would appear to be some technical problems in fitting copyright for mask works as now proposed in the pending bill, under the Universal Copyright Convention.

There is first the question of term. The Universal Convention ordinarily sets a term of 25 years from publication, or life of the author plus 25 years. There is an exception for photographic work and work of applied design. One would probably have to analogize mask works to either one of those categories to justify having a 10-year term rather than a 25-year term. I tend to think that that analogy would hold, but the term issue is the lesser of the problems.

Of greater significance is again the problem regarding what is a copy. The Universal Convention has a definition of publication in article VI which uses the word "copy" and which seems to do it in a fairly narrow way, especially since the Convention was developed when the *White-Smith* v. *Apollo* doctrine was in effect under U.S. law. Sound recordings, for example, are apparently not capable of publication under the Universal Convention and many countries do not protect sound recordings under copyright. The United States does, but many countries do not. There is a separate international convention to protect sound recordings, however, and our international obligations to protect sound recordings are based on the Phonogram Convention and not on the Universal Copyright Convention.

I mention this only because it does relate to the problem of what is a copy. If our domestic law is rather clear, that a semiconductor chip product is not a copy per se, but is rather simply to be treated as the equivalent of a copy for certain purposes, there may be a question as to whether the work is capable of publication under the Universal Convention. If it is not, then we cannot impose the notice requirements. You have those kind of problems regarding formalities.

Mr. SAWYER. Do I deduce from what you are saying that there may be a flip side to Mr. Mossinghoff's view and that is that might on the other hand be easier to get international acceptance if it is not part of the copyright law?

Ms. SCHRADER. I don't know. I would not say it would be easier. I would say you would have equal difficulty, and you might have to develop a new convention, as was done in the case of sound recordings. But again, I add that sound recordings are protected in some national laws under copyright.

I would add this further thought. If we do take the position that mask works are copyrightable subject matter and that they will be protected under the UCC, this will mean that the United States must accord national treatment to mask works. It means that we must protect the mask works of foreigners, even if U.S. citizens receive no protection for their mask works abroad.

It is true that the convention, in article IV provides for what is known as the comparison of terms, and, in theory, if there is no protection in the foreign country where the work originates, then the United States could refuse to protect the mask work under our law. But I think it is rather clear that under our law we would have to provide legislatively for this comparison of terms and provide that if the mask work is not protected abroad, then it will not be protected under U.S. law. Otherwise, under the UCC, we would accord national treatment.

Mr. SAWYER. Thank you.

Mr. KASTENMEIER. Well, I appreciate that rather detailed explanation. That was an excellent response and an informative response.

I have only one other question. Professor Patterson suggested among other things, that the copyright laws might not be precisely on all fours. It might be inappropriate in terms of remedies or in penalties for this field. He, without being very explicit, suggested that we might think of other remedies rather than those that are traditional.

Did you give any thoughts to any examination of the remedies under traditional copyright law as opposed to new remedies under design or other forms of protection?

Ms. SCHRADER. We certainly have given thought to the extent that the pending bill itself provides for somewhat different remedies. The pending bill would establish a compulsory license. The pending bill has a unique, innocent, infringement provision. Of course, these provisions are largely required because of the proposed extension of a use right.

However, even in the Senate subcommittee version where the use right has been eliminated, the innocent infringement provision has been retained. We tend to prefer the innocent infringement provision that appears in the design law because this provision basically places liability on the direct infringer or someone who is in collusion with the direct infringer, rather than in any way placing liability on the ultimate purchaser of the infringing product. As we understand the pending bill and the Senate subcommittee version, there is an attempt in some way to impose liability on those who are involved in using the work and who are not otherwise really making or selling the copyrighted work. Ordinarily copyright law would reach those who unlawfully sell, distribute, or reproduce a copyrighted work, rather than those who purchase it.

This is a matter, to some extent, of ambiguity. We realize that it is the intention in the Senate version, for example, to try to clarify these problems, but we tend to prefer the innocent infringer provision of the design bill. I said it is rather clear that you have liability under the design bill if you are either a direct infringer or if you are in collusion with the infringer or if you fail to disclose the source of the infringement. But the purpose is to get back to the one who is doing the actual infringing rather than the one who is on the receiving end of getting the product.

Mr. KASTENMEIER. Well, let me just say your testimony has been very helpful today and I think we will in fact want to work with you in terms of developing a bill here and we will be in touch with you. We appreciate the contribution today.

Ms. SCHRADER. Thank you very much.

Mr. KASTENMEIER. This concludes the hearings on copyright protection for semiconductor chips. The subcommittee, accordingly, stands adjourned.

[Whereupon, at 12:30 p.m., the subcommittee was adjourned.]

APPENDIXES

APPENDIX 1.—ADDITIONAL STATEMENTS

SIA SEMICONDUCTOR INDUSTRY ASSOCIATION
4320 Stevens Creek Blvd. • Suite 275 • San Jose, CA 95129 • (408) 246-1181

November 30, 1983

The Honorable Robert Kastenmeier
Chairman
Subcommittee on Courts, Civil Liberties
and the Administration of Justice
House Judiciary Committee
Room 2137
Rayburn House Office Building
Washington, DC 20515

Dear Mr. Kastenmeier:

The Semiconductor Industry Association would like to thank you for your efforts in connection with the Semiconductor Chip Protection Act (H.R. 1028).

Our industry has achieved and maintained very high rates of technological advancement since the development of the first commercial semiconductor devices in the 1950's. Today a one quarter inch square semiconductor chip which sells for under $10 is able to store far more information and perform more tasks than could the computers of thirty years ago, which occupied whole rooms and cost millions of dollars to produce.

This rapid technological advancement has been mirrored in our economic growth. Since the early 1970's, the U.S. semiconductor industry has enjoyed annual rates of growth in excess of 20%. The development of our products has played a direct role, as well, in the economic development of other U.S. high technology industries, which have grown at a real annual rate of 7% during the same period.

Much of this growth, both technological and economic, can be traced to the U.S. semiconductor industry's very high levels of research and development (R&D) and investment. In 1982 for the U.S. semiconductor industry as a whole, R&D expenditures as a percentage of sales were 10.7% and investment as a percentage of sales was over 14%. It is these expenditures which are threatened by semiconductor piracy.

The Honorable Robert Kastenmeier
November 30, 1983
Page 2

As you are aware, the R&D costs which firms must bear in order to create a new family of semiconductor devices have risen dramatically in recent years and for a complex microprocessor can now reach $100 million. Since pirate firms are able to copy the main chip of that family for as little as $50,000 to $100,000, or the entire family for less than $1 million, pirate firms have far lower up-front fixed costs. Pirate firms are, therefore, able to sell their copied product at a much lower price than would an innovative firm. The innovative firm, forced to meet the price set by its pirate competitor, would then achieve a much lower rate of return on its investment than originally anticipated. In some cases, firms' revenues have been reduced by tens of millions of dollars per year as a result of a single case of piracy. The result is that innovative product development is discouraged and fewer funds are available to cover past and future R&D investment costs.

The attached study prepared for the SIA provides a more detailed description of the negative effects of piracy on the U.S. semiconductor industry, and we request that it and this letter be made a part of the official record on H.R. 1028.

The SIA believes that the Semiconductor Chip Protection Act offers the best way in which to protect U.S. semiconductor firms from losses due to piracy, and hopes the bill will rapidly be enacted into law.

Sincerely yours,

Warren Davis

Warren Davis
Director, Government Relations
Semiconductor Industry
Association

cdh/H-30:3

THE ECONOMIC EFFECTS OF CHIP PIRACY ON THE U.S. SEMICONDUCTOR INDUSTRY

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Executive Summary

The piracy, or photographic copying, of innovative semiconductor chips is a serious threat to the domestic semiconductor industry. Piracy causes substantial losses of revenue to innovative semiconductor firms because pirate firms, which bear no product or market research and development (R&D) costs, have far lower fixed costs than do innovative firms. As a result, pirate firms are able to set far lower prices than innovative firms, which innovative firms must meet, and take market share previously held by innovative firms. The combination of price suppression and market share reduction leads to a significant decline in innovative firms' profits and revenues, and may actually drive innovative firms out of competition in the product lines they pioneered. Existing evidence indicates that the total revenue loss due to a single incident of chip piracy can be in the tens of millions of dollars per year for an innovative firm.

The impact of these piracy costs is severe. Two significant economic disincentives to innovation result from chip piracy. First, piracy immediately reduces funds available to innovative firms for investment and further R&D. New investment and R&D are the lifeblood of the semiconductor industry, and any reduction in funds available for those purposes is a major blow to a semiconductor firm. Only through continued R&D and investment have semiconductor firms been able to remain competitive for any extended period.

Second, the possibility of chip piracy must be taken into account by innovative firms in their planning for new product development. The threat of piracy has a significant negative impact on the willingness of firms to invest in new products, because the new products, if copied, may not provide the investing firm with an adequate return on its investment. Through both of these negative economic effects, chip piracy tends to reduce innovation in the semiconductor industry.

Savings to firms because of the elimination of chip piracy would likely be used by companies for R&D and reinvestment in new plant and equipment. U.S. semiconductor firms generally pay no dividends to their shareholders, nor has there been any significant level of merger activity between U.S. semiconductor firms. Furthermore, current high levels of demand for semiconductor products have made new investment in production capacity an even higher priority than under normal demand conditions.

I. COST TO THE SEMICONDUCTOR INDUSTRY DUE TO COPYING

Introduction

Aggregate data on revenues lost to the U.S. semiconductor industry as a result of the copying of semiconductor chip designs is not available. However, the general economic analysis presented in this paper clearly indicates qualitatively the nature of losses due to copying, and, together with some quantitative anecdotal evidence, can provide some general estimates of total sales lost to pirates each year. The following discussion illustrates the cost advantage available to a firm (hereafter "Firm B") which copies the chip design of an innovative firm (hereafter "Firm A"), and the way in which such copying threatens continued innovation. (Throughout this discussion, it is assumed that only Firm A and Firm B are active in the market. For a more detailed economic analysis, see Appendix 1.)

Pricing - Innovative Firm (Firm A)

Firms which develop an innovative semiconductor design must invest in the creation of far more than simply a new chip. They must also carry out a market research program to determine the characteristics to embody in the new design, they must develop other chips which can operate with the new product, and they must develop the software to accompany the new family of chips. For an advanced microprocessor chip, total development costs can reach $100 million.

When a semiconductor firm (Firm A) first introduces an innovative product, it holds a temporary position as the only seller of the new product line. As a result, Firm A is able to set its prices and its quantity of production at a level sufficient to cover its high development costs and yield some profit. This profit can then be applied to the development and production of still other semiconductor devices. Although firms in the semiconductor industry have always made every effort to reduce prices so as to expand the size of the semiconductor market, the prices charged by an innovative firm must necessarily reflect these past and future costs. This is the pattern of pricing and product development which has led the semiconductor industry to continually improved semiconductor capability, continually reduced semiconductor energy consumption and, ultimately, to continually declining semiconductor prices.

Pricing -- Copying Firm (Firm B)

A firm (Firm B) which chooses to copy the design of an innovative firm, however, faces a far lower set of development costs than does an innovative firm. The technology available for photographically copying and reproducing a semiconductor design permits the development of a copied product for as little as $50,000. The piracy of a full family of the most complex semiconductor devices would cost less than $1 million. In addition, the results of market survey and software development efforts carried out by the innovative firm are often available instantly to the copying firm.

The price which Firm B could charge for a product identical to Firm A's innovative product thus reflects Firm B's extremely low development costs. Furthermore, Firm B would anticipate no particularly high future costs for the development of its next product. Firm B need only wait for another company to produce a new product and then copy it.

The copying firm could therefore set its price so as to appropriate as much of the market as it has the capacity to serve while enjoying a high degree of profitability. At the loss of some short run profits, Firm B might even, in some circumstances, be able to set a price so low as to drive the innovative firm out of the product line altogether.

Effects on Innovative Firm (Firm A)

Because buyers of semiconductor products are very sensitive to price in their purchasing decisions (given equal quality),1/ Firm B's choice of price will instantly become the market price for the new semiconductor device, and Firm A will achieve a reasonable volume of sales only by meeting that price. This price suppression is one effect of copying on Firm A.

The extreme situation would be for Firm A to leave the market altogether. This would occur if Firm B were to set the price of its product so low that Firm A would not only be unable

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1/ A study conducted in 1977 by the FTC stated "Buyers of semiconductors are highly sophisticated in comparing prices and the electrical characteristics of different products. For that reason, price competition appears to be very strong." Federal Trade Commission, Bureau of Economics, The Semiconductor Industry: A Summary of Structure, Conduct and Performance 140 (1977).

to recover fully distributed costs on each sale but would not earn sufficient revenue to cover immediate (variable) costs of production for the product.

The other effect is a reduction in the quantity of sales made by Firm A. Although a lower price will result in an expansion in total market size, the level of sales that Firm A can make will be determined by the pricing and production strategy of Firm B which, because of its lower cost structure, now exercises effective control of the market.

The combined negative effects of price suppression and lost sales would be a substantial loss of revenue for Firm A. Existing evidence indicates that the size of these revenue losses can be in the tens of millions of dollars per year for a single firm.2/

Copyright legislation protecting against chip piracy would permit a U.S. semiconductor firm to initiate action to stop the sale of pirated chips in the U.S. market. Since the domestic market represents over half of the world semiconductor market, such exclusion would have a strong negative impact on

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2/ In a case before the International Trade Commission, for instance, Zilog Corporation has alleged that Nippon Electric Company (NEC) copied its Z-80 microprocessor chip. Since NEC's version of the chip entered the market in 1979, Z-80 prices have fallen from $6.32 to $2.82. During the same time, NEC's annual sales of its version of the Z-80 reached 3 million units -- approximately the same level as Zilog's sales.

In another case, in August 1982, Intersil, Inc. filed a suit against Teledyne, Inc. alleging that Intersil had suffered total damages of $7 million in the copying of a family of relatively inexpensive analog-to-digital converter chips. The suit has been settled.

semiconductor chip piracy. Alternatively, Firm A might license Firm B to continue to produce the pirated chip and thereby create a flow of royalty payments sufficient to offset Firm B's price advantage due to copying.

II. LIKELY USE OF FUNDS SAVED

It has been the long-standing policy of U.S. semiconductor firms to reinvest all new revenues in the semiconductor business. U.S. semiconductor firms generally pay no dividends to their shareholders, nor has there been any significant level of merger activity between U.S. semiconductor firms. This is the result of the investment intensive nature of the industry.

The development of a new chip can, as described in the previous section, can cost a firm as much as $100 million. Furthermore, a new plant to produce semiconductors can also cost upwards of $100 million. Costs of this magnitude are no longer unusual within the semiconductor industry, and they must be incurred if a firm expects to remain at the forefront of the industry. Development and production of semiconductor devices which are more powerful, more energy efficient, and smaller is essential if a firm wishes to expand or even simply maintain its level of sales.

As a result, the U.S. semiconductor industry has traditionally exhibited one of the highest levels of capital and R&D expenditures as a percentage of sales of any U.S. industry. Between 1976 and 1982 the U.S. semiconductor firms invested over

$8 billion in plant and equipment as compared with $4 billion over the same period by Japanese producers.3/ Under current economic conditions in which semiconductor demand has outpaced firms' production capabilities, the pressure to increase output creates an additional requirement for capital investment. The following chart illustrates that the trend is for the level of these expenditures to continue to increase.

R&D And Capital Expenditures As A Percent Of Sales
For The U.S. Semiconductor Industry

	1975	1976	1977	1978	1979	1980	1981	1982
R&D Expenditures	8.6	6.8	7.9	8.2	7.2	7.5	9.7	10.7
Capital Expenditures	5.7	9.3	10.9	14	13.6	15.5	18.4	14.7
Total	14.3	16.1	18.8	22.2	20.8	24	28.1	25.4

Source: Technecon, Inc.

Given the strong inherent requirement for R&D and investment in the semiconductor industry, any increase in a chip firm's revenues, such as would be obtained by the elimination of semiconductor piracy, would most likely be invested in new capital or used to finance R&D.

3/ Source: U.S. Department of Commerce Data.

Appendix 1

Graphical Analysis

The graphs in this section depict various aspects of the cost of copying as described in Section I.

The X axes for these graphs measure the quantity of the semiconductors produced or consumed. The Y axes measure the cost per unit of production or price at a given level of production. This analysis is based upon the use of six types of curves.

Demand curves (D) are the series of points which show the quantity of a product which would be purchased at a given price (or alternatively, the minimum price per unit at which a given quantity of a product could be sold.)

Marginal Revenue curves (MR) are the series of points which show the additional revenue a firm would earn for each additional unit of sales.

Average Fixed Cost curves (AFC) depict per unit fixed costs. Fixed costs are those expenditures on such things as R&D, plant and equipment which have been made prior to initiation of the production process or which, in the short run, must be paid regardless of production levels. Each point on the AFC curve is determined by dividing total fixed costs at a given level of output by the number of units produced. As a result, AFC curves are constantly declining as production increases.

Average Variable Cost curves (AVC) show the costs of those items such as labor, electricity, and heating which can be controlled by management in the short run. Each point on the AVC curve is determined by dividing total variable costs at a given level of output by the quantity of output.

The Average Total Cost curve (AC) for a firm is simply the combination of the AFC and AVC curves for that firm. Each point on the AC curve is determined by dividing fixed and variable costs (i.e. total costs) at a given level of output by the quantity of output.

Marginal Cost curves (MC) are the series of points which show the additional costs experienced by a firm for each additional unit of production.

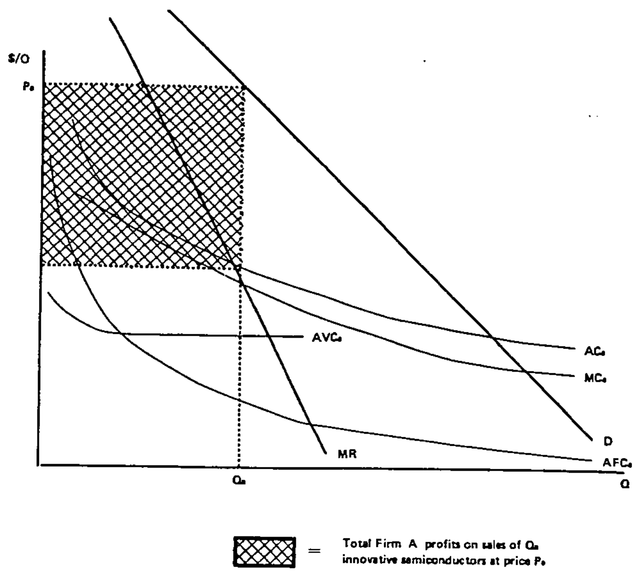
In all cases in this analysis, the Demand and Marginal Revenue curves are held constant and are identical for both firms because both serve the same market. The cost curves are different for each of the two firms, but are held constant for each firm throughout this analysis. All the cost curves shown reflect economies of scale -- a condition present for virtually every new semiconductor product -- and thus decline as total production increases. The primary difference in production cost between Firm A and Firm B is shown by their average fixed cost curves (AFC). Because of the difference in cost borne by each firm for product development, Firm A's AFC curve is considerably higher than is Firm B's.

Variable costs on the other hand, might be lower for Firm A which developed and introduced the new product and which may utilize more efficient production technologies and techniques. As drawn, therefore, Firm A's average variable cost curve (AVC_a)

is lower than Firm B's (AVC_b). This small cost advantage to Firm A, however, is far outweighed by Firm B's lower level of fixed costs.

The equilibrium conditions which these graphs demonstrate are illustrative only. Other firms with different cost structures would exhibit different levels of profit or loss. However, the graphs drawn here do provide an accurate and vivid indication of the nature of the injury which can be caused by copying.

GRAPH A PRICE SETTING AND PROFITS FOR FIRM A's INNOVATIVE PRODUCT ABSENT COMPETITION FROM A COPIED VERSION



As illustrated in Graph A, Firm A which introduces a new semiconductor product would produce to sell a quantity Q_a of its new chips because that is the quantity at which its Marginal Costs (MC_a) equal its Marginal Revenues (MR) and is therefore the quantity at which profit is maximized. Because no one else had yet developed the new product, Firm A could expect to hold some degree of market power in that product line, and could be expected to price at P_a so as to earn a profit on the sale of the new product.1/ This profit is indicated on Graph A as the diagonally crossed area.

The average fixed cost curve (AFC_a), the marginal cost curve (MCa) and average cost curve (AC_a) reflect the costs associated with the development, production and marketing of the innovative new device by Firm A. Average fixed costs in this example make up approximately one-third of Firm A's total average costs at quantity Q_a. Product development costs can be assumed to represent approximately half of those fixed costs.

If another firm, Firm B, were now to copy Firm A's new chip, the economic outlook for Firm A would change dramatically. Graph B1 illustrates the price (P_b) at which Firm B, a copying firm, could sell its product if it were to choose to appropriate only

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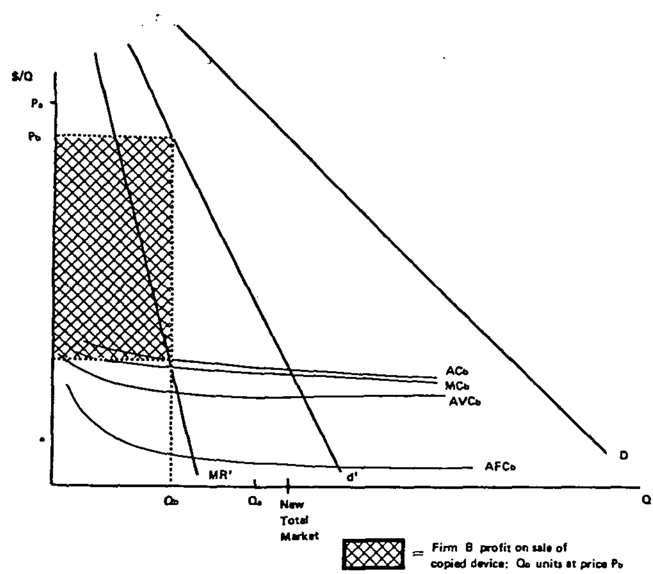
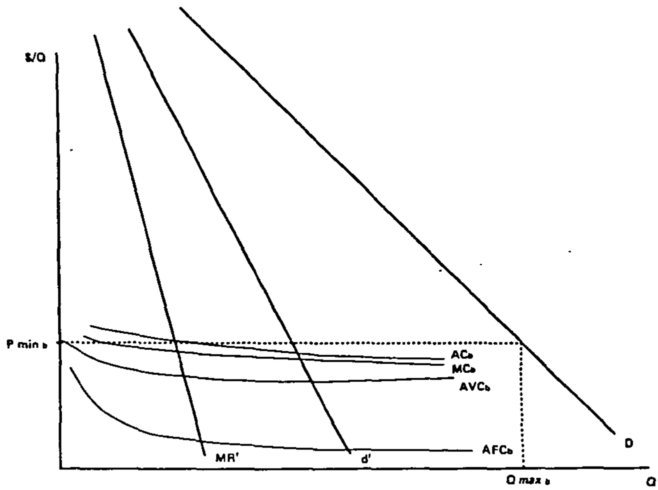
1/ A standard pricing practice in the semiconductor industry (said to have been introduced in the U.S. by Henry Ford in pricing the Model T) is to anticipate future reductions in production costs and to price according to predicted future costs in order to expand the size of the market more rapidly. The cost curves as drawn, therefore, would more accurately be viewed as anticipated future cost curves. Nevertheless, the graphs do portray the type of injury Firm A would suffer due to piracy.

half the market. This analysis assumes that Firm B has fixed costs 50% lower than Firm A because it bears no product and market R&D costs. Note also that once Firm B has decided to split the market with Firm A it faces a new demand curve (d') and new Marginal Revenue Curve (MR') which reflect a market half the size of the original market. Firm B would price at P_b -- a price somewhat less than Pa-- and, because of demand elasticity, would sell a quantity Q_b which is less than Qa and equal to one-half the new total market. At this combination of price and sales, Firm B would earn a profit as shown in the diagonally crossed portion of Graph B1.

GRAPH B1 FIRM B INTRODUCES COPIED CHIP WITH INTENTION OF DIVIDING THE MARKET WITH FIRM A



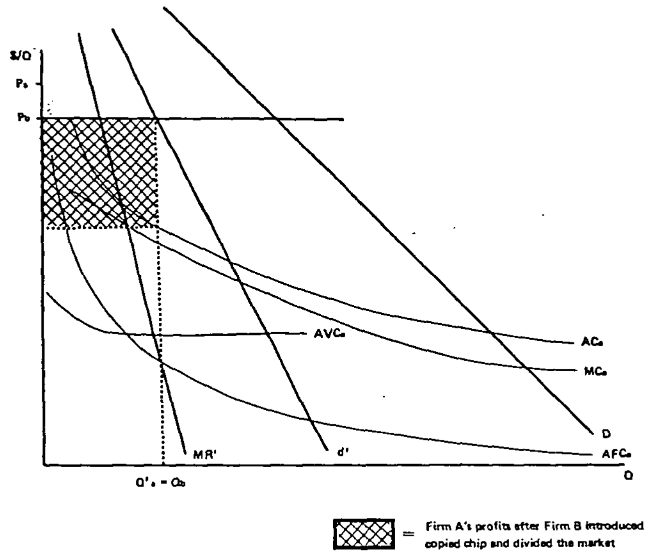
GRAPH B2 FIRM B CHOOSES TO DRIVE FIRM A OUT OF BUSINESS AND TAKES ENTIRE MARKET*



*Note that Firm B can price at Pminb and still operate at the breakeven point.

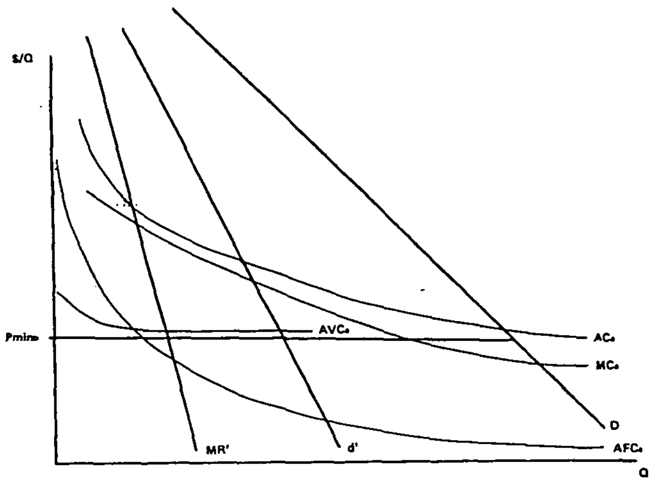
However, were Firm B later to choose to take as much market share as possible without losing any money it could price as low as P_{minb}. Graph B2 shows that at sales of Q_b or greater Firm B's revenues would exceed its average costs at price P_{minb}. In Graph B2, Firm B has taken over the entire market and therefore operates using the market demand curve (D). P_{minb}, however was set taking into account the level of production in Graph B1 because it is from that level of production that Firm B will begin to expand its sales. Only at a price of Pminb or higher can this expansion occur without Firm B ever suffering a loss.

GRAPH C1 FIRM A's PROFITS AFTER MARKET IS DIVIDED EQUALLY WITH FIRM B's COPIED CHIP



Graph C1 depicts Firm A's response to a decision by Firm B to evenly divide the market for Firm A's innovative product. Firm A must accept price P_b as set by Firm B and must also accept a decrease in its market size to Q'_a ($Q'_a = Q_b$ because the market has been evenly divided). At this combination, Firm A will continue to earn a profit (shown as the diagonally crossed area in Graph C1) but a much smaller profit than was earned by Firm B at the same level of production and far smaller than Firm A's profits before suffering piratical competition from Firm B's copied chip.

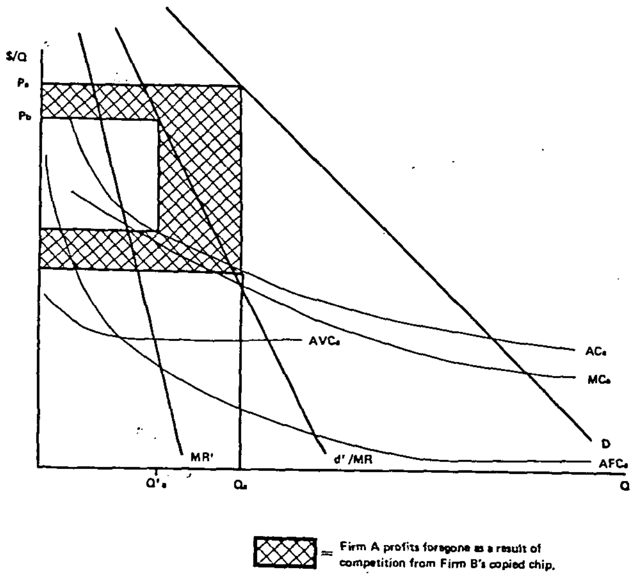
GRAPH C2 FIRM A IS DRIVEN OUT OF BUSINESS BY FIRM B WHEN FIRM B PRICES AT Pminb, BELOW FIRM A's AVC CURVE



In the extreme case in which Firm B elects to price so as to take over the entire market, Firm A would indeed be driven from that product line. Graph C2 illustrates that if Firm A were to lower its price to P_{minb} in order to meet Firm B's price, Firm A would not only forego its profits and sell at a loss but would be unable to continue production of its new chip because its revenues would be insufficient to cover its average variable costs of production (i.e., $AVC_a > P_{minb}$ at all points).

Graph C2 summarized the worst case scenario in which Firm A is driven out of business in the product line it developed -- without Firm B even suffering any temporary losses. Graphs D1 and D2 summarize the scenario in which Firm B elects to split the market evenly between the two firms.

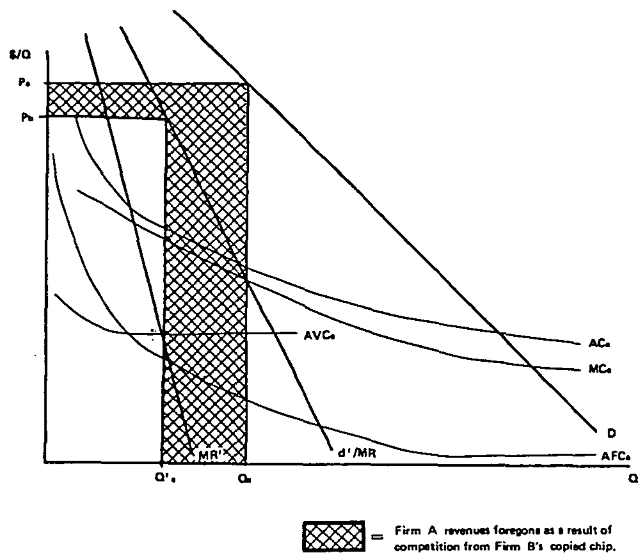
GRAPH D1 REDUCTION OF FIRM A's PROFITS WHEN MARKET IS DIVIDED EQUALLY WITH FIRM B



The diagonally crossed area in Graph D1 illustrates the difference between profits earned by Firm A before and after competition from Firm B's copied chip . The difference is the quantity of profits not available to Firm A for further investment.

Graph D2 illustrates the difference in Firm A's revenues earned before and after piratical competition from Firm B's copied chip, assuming an even division of the market after Firm B introduced its chip. This difference, shown as the diagonally crossed area of Graph D2, represents the quantity of revenues not available for future R&D efforts by Firm A.

GRAPH D2 REDUCTION OF FIRM A's REVENUES WHEN MARKET IS DIVIDED EQUALLY WITH FIRM B



In Graphs D1 and D2, however, Firm A has been able to cover its development costs for the new semiconductor device. In Graph C2 this was not the case. Thus total costs to Firm A would range from a severe reduction in profits and revenues (and thus a reduction in future innovative activity) to an inability to continue to compete in a product line it had pioneered.

The conclusions to be drawn from this examination of the economics of chip piracy include:

1. Pirate firms can readily earn a profit because their costs will not reflect the very high R&D costs borne by an innovative firm.

2. Pirate firms can price at a far lower level than can innovative firms, and in the process can appropriate market share from the original manufacturer.

3. One result of piracy will be an erosion of the innovative firm's profits and revenues.

4. In the extreme case, the innovative firm can be driven out of the market for the product it developed.

cdh/H-11:37

STATEMENT OF NEC ELECTRONICS U.S.A., INC.

on H.R. 1028

Submitted to the Subcommittee

on

Courts, Civil Liberties and

the Administration of Justice

of the

House Committee on the Judiciary

August 3, 1983

STATEMENT OF NEC ELECTRONICS U.S.A. INC.

NEC Electronics U.S.A. Inc. ("NEC Electronics") appreciates this opportunity to comment on H.R. 1028, a bill to bring semiconductor chip products and the underlying mask works within the protection of the copyright laws. As a manufacturer and marketer of integrated circuits, we generally support legislation to create protection for semiconductor chips because we believe that greater certainty in the area of proprietary rights will benefit the industry as a whole. Also, in light of the tremendous commitment to research and development that will be necessary in order to continue the advance of semiconductor technology, we feel that legislation to protect future innovation is appropriate.

NEC Electronics is a wholly-owned American subsidiary of NEC Corporation, a multinational enterprise based in Japan. We consider ourselves to be an American company competing in this market against other American companies. We are headquartered in Mountain View, California, where we have a plant which manufactures semiconductor chips and employs approximately 500 persons. We are currently building an additional plant in Roseville, California, which will manufacture completely (from wafer fabrication through assembly and test) very large-scale integrated circuits. When completed, the Roseville facility will employ approximately 1500 persons.

Reverse Engineering

Like everyone else concerned with this bill, we believe that the twin goals of certainty and encouragement of innovation can be achieved only if legitimate reverse engineering is permitted. We feel that existing "fair use" provisions of Section 107 of the Copyright Law may not be sufficient, however, as they tend to emphasize non-commercial purposes. The purpose of much reverse engineering activity is clearly to maintain a commercial position in a highly competitive industry.

Representative Edwards in his statement introducing H.R. 1028 said, "Legitimate reverse engineering is not prohibited by the bill." Congressional Record, Thursday, February 24, 1983, Vol. 129, No. 20. It should be established beyond doubt in the bill that such practices, which have all been accepted in the industry as necessary and legitimate, are not intended to be prohibited by the bill. In order to insure this right to reverse engineer is protected, a definition of reverse engineering should be included in the bill. An excellent definition is found in the testimony of F. Thomas Dunlap, Jr., Corporate Counsel and Secretary of Intel Corporation, given on May 19, 1983 before the Committee of Judiciary Subcommittee on Patents, Copyrights and Trademarks. In that testimony, Mr. Dunlap stated: "A reverse engineering firm should be allowed to analyze the chip, draw a circuit schematic of the chip, and then lay out a different pattern. This pattern could be used to fabricate a version of the semiconductor chip which is functionally equivalent to the original chip but has different visual patterns on it."

Retroactivity

While desirous of legislation in the semiconductor chip area, we also wish to call to your attention the danger that this bill could be applied retroactively. Retroactive application could penalize manufacturers for conduct wholly lawful when undertaken, which raises serious constitutional questions and the related danger of future litigation. In addition, it is inconsistent with the traditional congressional practice in bringing new subject matter or rights within the copyright laws, which reflects a fundamental policy against "recapturing" works from the public domain.

The provisions of Section 9 of H.R. 1028 exclude semiconductor chip products and masks previously manufactured in the United States from retroactive application. Therefore, a United States manufacturer may continue using masks that were created prior to the effective date of the legislation, while a foreign manufacturer could not continue to use its masks from the same time period if those masks were subject to an infringement action. Many United States-based companies also manufacture their products outside the United States and might be penalized by retroactive application.

A concern may be raised that unless the bill contains some retroactive application, manufacturers might be inhibited from introducing new chips before the new law goes into effect, while potential "pirates" might hasten to introduce copied chips before the bill's effective date. We believe these concerns can be addressed by providing prospective application from the date of introduction by Congressman Edwards of H.R. 1028. Chips that were introduced into commerce before that date, however, should not be affected by the legislation.

We understand that language addressing, at least to some extent, the concerns we have raised, is currently being circulated among the Senate Subcommittee that has jurisdiction over a companion bill, S1201. We would be happy to work with your Subcommittee on these points.

Once again, we are grateful for this opportunity to express our views.

Respectfully,

Robert C. Hinckley
General Counsel

30-425 O—84——14

June 28, 1983

The Honorable Robert W. Kastenmeier
2232 Rayburn
House of Representatives
Washington, D.C. 20515

Dear Mr. Kastenmeier:

I appeared with Dr. Christopher K. Layton, Vice President-RTP Operations, Intersil, Inc., who testified on May 19, 1983 on behalf of Intersil and the Semiconductor Industry Association in support of Senate Bill 1201.

I recently recognized that we had failed to supply you with a copy of Dr. Layton's testimony and forward a copy herewith.

I am glad to hear that hearings will be held on H.R. 1028 in San Jose. Intersil and the Semiconductor Industry Association strongly support S.1201 and the companion bill H.R. 1028.

Sincerely,

Stanley C. Corwin
Patent Counsel

SCC:br

Enclosure

cc: Dr. C. K. Layton

TESTIMONY OF
DR. CHRISTOPHER K. LAYTON
INTERSIL, INC.

SUMMARY

My testimony addresses the economic impact on a semiconductor company when its original integrated circuit design is copied. The investment in originating the design of an integrated circuit is substantial. Recoupment of that investment becomes tenuous at best when competition comes in the form of copies of the design, the copy, having been brought to the market for as little as ten percent of the originator's investment. And while a new integrated circuit design affects many different industries as it constitutes a new building block for many new products, the copy of the design offers nothing more than an imitation of the original.

Innovation in the semiconductor industry requires positive protection for mask works - the blueprint of the design of an integrated circuit. The Semiconductor Industry Association strongly supports enactment of the Semiconductor Chip Protection Act of 1983 as providing the definitive protection that is needed.

Good morning, Mr. Chairman and members of the subcommittee. My name is Christopher K. Layton and I am Vice President of Operations - Research Triangle Park for Intersil, Inc., a subsidiary of General Electric Company. I thank you for the opportunity to testify today on behalf of the Semiconductor Industry Association (SIA).

SIA is a trade association of small and large United States-based companies. The members include diversified companies like General Electric and companies like Intersil who are exclusively manufacturers of semiconductor products. SIA represents an association of 57 member companies constituting approximately 95% of all United States-based semiconductor companies. The primary focus of SIA is semiconductor industry problems. SIA strongly supports enactment of S.1201.

Intersil and General Electric Company also support enactment of S.1201.

While my testimony today is on behalf of the Semiconductor Industry Association, I will draw upon our experiences at Intersil, Inc. Intersil, headquartered in Cupertino, California, in the heart of "Silicon Valley", is a small to medium size company, employing approximately 2700 employees. Intersil is engaged in the design, development, manufacture and sale of various integrated circuit products including analog circuits, data acquisition products and digital, low power CMOS and bipolar LSI circuits.

Intersil is an originator of unique standard and custom integrated circuits, yet faces intense and widespread competition, both domestic and foreign. While most of this competition comes from continuous introduction of new products into the marketplace, some of this competition has been experienced by Intersil in the form of having its products copied. To this end, I will focus my testimony today on:

1. The economic impact on a chip originator when its design is copied.

I will secondarily address:

2. The need for certainty in the law.
3. Some suggested changes to S.1201.

1. THE ECONOMIC IMPACT ON A CHIP ORIGINATOR WHEN ITS DESIGN IS COPIED

In the late 1970's, Intersil originated the design of a family of analog to digital converter chips. These were the first chips of their kind, where both the analog circuitry and the digital circuitry were on the same chip. These chips are approximately one-eighth inch square and contain approximately 1200 transistors. (Today, this would be considered a relatively simple chip.) These chips have many uses, the most common being to drive a multimeter. These are the types of meters used by electronics engineers and technicians to measure voltage, current and resistance.

When these chips were introduced into the market, they were a huge success. Then they were copied and this led to litigation, now settled, which I will touch on later.

In order to realize what it means financially to a company like Intersil to have one of its designs copied and then appear in the marketplace as a competitive product, I think we should first look at the investment it takes, not only in dollars, but also in time and effort, to originate a design and bring it to market.

Again, my point of reference is a typical chip of the order and complexity of Intersil's family of single chip analog to digital converters. Such a typical chip would go through the following design and development cycle:

a) Marketing makes a study to define product need.

b) Marketing and engineering conceive of a product to fill the defined need. This includes establishing design objectives and desired specifications (voltage input/output levels, signal to noise sensitivity, how many pins required, etc.).

c) Engineering prepares logic diagram.

d) Engineering prepares detailed circuit diagram.

e) Engineering establishes device details such as the sizes of the various circuit components.

f) Design engineers work with the layout designers to prepare the general layout plan.

g) A detailed layout plan is prepared for certain sections of the circuitry.

h) The composite drawing is prepared. The composite drawing is like a map. It contains all of the various mask layers to be created with each of the shapes and placements of all the 1200 transistors and other components (including resistors, capacitors and conductors) being shown usually in multiple colors, one color for each mask layer.

I'd like to stop here and look at what has been done and the size of the investment thus far in the design cycle. I would estimate about 2-3 months of marketing involvement of probably two persons (i.e., six man-months) - an investment of about $50,000. The engineering effort is in the order of two man-years, or about a $200,000 investment. It takes about one man-year to lay out a chip of the complexity of Intersil's single chip analog to digital converter. The layout adds about another $75,000 to the investment, to arrive at an investment in the initial design of approximately $325,000. <u>This entire investment is avoided by the copier</u>.

Continuing on with the development of a new design:

i) The composite drawing is translated into an interactive graphics (computer-aided design or CAD) system. CAD systems are widely used in the semiconductor industry as a key design tool. Such systems are quite sophisticated and can easily represent an investment of over one million dollars for a company like Intersil.

j) The CAD system is used in the process of making photographic masters for the masks, there being roughly 8 or 9 mask layers for the type chip I refer to. This process of using the CAD system is a multiple step process and may require repeated checking for errors.

k) The next step is the generation of the mask sets. These are glass plates with clear and opaque areas to delineate the portions of the semiconductor material exposed to processing and the portions that are to be shielded from processing. Each glass plate contains one mask layer in a repeated pattern sufficient to imprint hundreds of the same pattern onto the semiconductor material. In this way a wafer is fabricated and each wafer contains hundreds of chips.

l) Samples of the chips are returned to engineering for characterization, a process of testing and comparing the samples against the specifications. If needed, corrections in the design and/or process are made; the layout may need to be corrected and new masks made.

m) New samples are run and characterized.

n) Data sheets and application notes are drawn up.

Looking at the development period, from the time the composite drawing is initially prepared to the time the chip is ready for production, it is not uncommon for at least another $100,000 to be expended in addition to the design and layout expense of $325,000 in our example.

Now let's look at the copier. The copier has the product defined for it, the success in the market is established, the risk of failure is virtually zero, and the blueprint for the product, in the form of the mask patterns, is readily available from the chip itself. The copier buys a few integrated circuits, strips away the package to expose the chip, photographs the chip at a magnification of about 400x and the resulting photograph is used to duplicate the composite drawing. Assuming the copier's manufacturing process is substantially the same as the chip originator's process, the duplicating effort is basically done. The copier only has to generate the masks to completely duplicate the originator's product.

A chip of the complexity of Intersil's analog to digital converter chips, I would estimate, could be duplicated and on the market in a matter of three to six months at an investment of about $30,000-$50,000. This is approximately one-tenth of the investment a chip originator would make.

The net effect of having an original integrated circuit product copied is that the expected recovery period for the engineering investment has been sharply reduced, often to the point where the investment is not recovered. Additionally, the origination of a new integrated circuit product creates opportunities for many new products to be designed incorporating the integrated circuit. The copy of the original integrated circuit creates no such new product design opportunities.

When I reflect on what has happened to Intersil and many other semiconductor companies, and what will probably continue to happen if the proposed legislation does not become law, I am convinced of the need for the protection this legislation will provide. It is plain to me that without such protection, original design work will be curtailed. Each company will create fewer original chips and instead partake in the immediate economic shortcut of copying to the detriment of the United States industrial base and worldwide competitive effort.

I think you can see from the foregoing that the mask design (mask work) is the key to copying. The mask design is the blueprint - the sum total of all the work that went into the design of the circuit. And the integrated circuit chip is one of the few products I am aware of where the blueprint is imprinted on the product itself, available for any would-be copier.

While patent protection on the circuit design may provide some relief, there are several problems which patent protection cannot address. Some very unique products - like managing to put analog circuitry and digital circuitry on the same chip - may not contain unique circuit designs of a patentable nature. Yet the layout (the mask work) for such a product is quite unique, involving much original and innovative effort. Patents cannot protect that effort. Further, obtaining patent protection is a time-consuming process, whereas copyright protection can be quickly secured.

What is needed is protection for the mask design. While Intersil believes that the copyright law today does provide protection for mask works, I know that this opinion is not shared by many and herein lies the problem. The protection provided by the law today is certainly not as clear and specific as it can and should be.

2. THE NEED FOR CERTAINTY IN THE LAW

In considering the need for certainty in the law, I believe you may consider Intersil as being typical. Situated in Silicon Valley, it is very much part of that entrepreneurial climate. Part of the climate is creativity. Here is where a significantly large number of the world's unique integrated circuit designs originate. Here is also where much reverse engineering takes place.

Reverse engineering can include a truly creative effort, where only the form, fit and function of another's product are duplicated so as to present a different alternative to the product. But, reverse engineering can also be a euphemism for copying. Here the chip is reproduced in exact detail by means of reproduction of the mask design. S.1201 will of course protect only against the latter course of conduct - the out and out blatant copying of everything the innovator has done. It will not and should not stop a competitor from designing and manufacturing a compatible substitute to an existing design.

Intersil, from its own experience, is particularly sensitive to the need for the express definition in the law that will be provided by S.1201, and its experience illustrates why the semiconductor industry as a whole supports the bill. In 1982, having experienced the copying of an entire family of its analog to digital converter chips, Intersil filed suit under the federal copyright law. Our case was based upon our belief that mask designs, like other blueprints, are protected by the copyright law.

It was clear at the outset of the case that the defendant, which is a reputable company also located in Silicon Valley, believed with equal conviction that the copyright law did not cover masks and that what they had done was nothing more than permissible reverse engineering.

This case, to my knowledge, was among the first, if not the first, of its kind. And while its prosecution through a full trial and appeal would have added definition to the law in this area (and perhaps made legislation unnecessary), the costs of litigation coupled with the very uncertainty of the law led management of both companies to settle.

It is my firm belief that had the law been clearer, had it specifically addressed protection for mask designs of integrated circuits, there would have been no need for litigation as there would not have been two opposite views of what the law is.

The Semiconductor Chip Protection Act of 1983, in my opinion, brings the very certainty to the law that is now lacking. This uncertainty is due in part to there being no clear precedent in the case law. I think it is also due to the fact that some consideration was given in 1979 to specifically include mask works in the copyright law but that effort was not carried through. Some may look at the 1979 experience as an indication that the present copyright law does not cover mask works.

In summary, innovation in the semiconductor industry requires positive protection for mask works. Patents cannot do the job and present copyright law is not certain enough to preclude costly and time consuming litigation. We feel that the definitive copyright protection to be provided by S.1201 will be of benefit to the semiconductor industry and the nation as a whole.

3. SOME SUGGESTED CHANGES TO S.1201

While I am not an attorney, I have reviewed S.1201 in detail with my lawyer, Stanley C. Corwin, Intersil's Patent Counsel, who accompanies me here today, and we believe we have found some language in the bill which, with minor changes, can hopefully improve the bill. These suggested changes represent our own thoughts for your consideration, and I do not present them on behalf of SIA. I append a copy of the bill marked up with these suggested changes, additions being underlined and deletions contained in brackets.

1. (Sec. 4. Section 106) The first change we suggest concerns the need for protecting less than the whole mask work. In some cases only key major segments are copied. Accordingly, we propose broadening the definition of exclusive rights to extend to the mask work <u>or a substantial part thereof</u>.
2. (Sec. 5(a). Section 119) There may be reasons for a copyright owner to revoke a license other than "only for failure to make timely payments of royalties". We have accordingly suggested language to extend this remedy of revocation to other defaults under the license agreement.
3. (Sec. 7. Section 501) This section raises some concern. Section 501 allows the good faith distributor to be free from liability for the distribution of a copier's semiconductor chip products prior to receipt of notice of infringement. This places a high burden on the chip originator to identify all the various distributors of a copier and to give prompt notice. This section eliminates the duty of inquiry on the part of the distributor.

   It is suggested that Section 501 should not eliminate liability for distribution prior to notice. If the chip originator could proceed against the distributor for past distribution, the distributor could in turn look to the copier for indemnity.
4. Finally, it is not clear from our reading of S.1201 that all provisions of Title 17 of the United States Code, beyond those provisions particularly noted in the bill, apply to semiconductor chip products and to mask works.

Thank you for the opportunity to testify this morning. I would be happy to answer any questions.

DR. CHRISTOPHER K. LAYTON
VICE PRESIDENT - RTP OPERATIONS
INTERSIL, INC.
RESEARCH TRIANGLE PARK, NORTH CAROLINA

A native of St. Neots, England, Dr. Layton completed his undergraduate work at City University of London, and Doctorate work at Imperial College. He received his Ph.D. in Materials from London University in 1969.

He joined Intersil in March, 1982, as Managing Director of the Research Triangle Park facility, responsible for manufacturing, plant operations, and process development. In January 1983 he was named Vice President of Operations for Research Triangle Park.

Before joining Intersil (a subsidiary of General Electric Company), Dr. Layton was General Manager of Manufacturing of General Electric's Microelectronics Center at Research Triangle Park. Previously from 1979 to 1981 he was Manager of Fab Operations for the Mostek Corporation in Carrollton, Texas. He was in charge of the advanced technology 64K dynamic N-Channel RAM product line. Earlier he worked with the Harris Corporation, Semiconductor Group in Melbourne, Florida as Director of Wafer Manufacturing where he established the CMOS manufacturing operation. Prior to joining Harris in 1974, Dr. Layton held manufacturing and R&D management positions with a subsidiary of Northern Telecom in Ottawa, Canada, responsible for developing and implementing MOS technologies.

STANLEY C. CORWIN
PATENT COUNSEL
INTERSIL, INC.
CUPERTINO, CALIFORNIA

B.S. in Electrical Engineering, Antioch College, Yellow Springs, Ohio - 1958

L.L.B. Georgetown University, Washington, D.C. - 1965

Member of the bar - State of Virginia and United States Patent and Trademark Office

He has served as Patent Counsel for Intersil since June, 1981 and is presently also Patent Counsel for the Semiconductor Division of General Electric Company. Prior to June, 1981, Mr. Corwin served for nine years as Patent Counsel to the Television Division of General Electric Company and previously held various other patent legal positions within General Electric.

ADDENDUM

179818.260

98th CONGRESS
1st Session

S. 1201

IN THE SENATE OF THE UNITED STATES

Mr. Mathias (for himself and Mr. Hart) introduced the following bill; which was read twice and referred to the Committee on ____

A BILL

To amend title 17 of the United States Code to protect semiconductor chips and masks against unauthorized duplication, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Semiconductor Chip Protection Act of 1983".

DEFINITIONS

Sec. 2. Section 101 of title 17 of the United States Code is amended by adding at the end thereof the following:

"A 'semiconductor chip product' is the final or intermediate form of a product--

"(1) having two or more layers of metallic, insulating, or semiconductor material, deposited on or etched away from a piece of semiconductor material in accordance with a predetermined pattern;

"(2) intended to perform electronic circuitry functions; and

"(3) that is a writing or a discovery, or the manufacture, use, or distribution of which is in or affects commerce.

"A 'mask work' is a series of related images--

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''(1) having the predetermined, three-dimensional pattern of metallic, insulating, or semiconductor material present or removed from the layers of a semiconductor chip product; and

''(2) in which series the relation of the images to one another is that each image has the pattern of the surface of one form of the semiconductor chip product.

''A 'mask' is a substantially two-dimensional, partially transparent and partially opaque sheet. A mask embodies a mask work if the pattern of transparent and opaque portions of the mask is substantially similar to the pattern of one of the images of the mask work. Masks and mask works shall not be deemed pictorial, graphic, or sculptural works. The copyright in a mask or mask work shall not extend to any other work of authorship embodied therein.

''As used in sections 109 (a), 401, 405, 406, 501 (A), 503, 506, 509, and 602 of this title, 'copy' includes a semiconductor chip product that is subject to the exclusive rights described in section 106.''.

SUBJECT MATTER OF COPYRIGHT

Sec. 3. Section 102 (a) of title 17 of the United States Code is amended—

(1) by adding after paragraph (5) the following:

''(6) mask works;''; and

(2) by redesignating paragraphs (6) and (7) as paragraphs (7) and (8), respectively.

EXCLUSIVE RIGHTS

Sec. 4. Section 106 of title 17 of the United States Code is amended--

(1) by striking out ''and'' at the end of paragraph (4);

(2) by striking out the period at the end of

paragraph (5) and inserting ''; and'' in lieu thereof; and

(3) adding at the end thereof the following:

''(6) in the case of mask works--

''(A) to embody the mask work or a substantial part thereof in a mask;

''(B) to distribute a mask embodying the mask work or a substantial part thereof;

''(C) to use a mask embodying the mask work or a substantial part thereof to make a semiconductor chip product;

''(D) in the manufacture of a semiconductor chip product, substantially to reproduce, by optical, electronic, or other means, images of the mask work or a substantial part thereof on material intended to be part of the semiconductor chip product; and

''(E) to distribute or use a semiconductor chip product made as described in subparagraph (C) or (D) of this paragraph.''.

LIMITATION ON EXCLUSIVE RIGHTS AS TO MASKS

Sec. 5. (a) Chapter 1 of title 17 of the United States Code is amended by adding at the end the following:

''§ 119. Scope of exclusive rights: Compulsory licensing with respect to mask works

''(a) In the case of mask works, the exclusive rights provided by section 106 are subject to compulsory licensing under the conditions specified by this section.

''(b) The owner of a copyright on a mask work shall be required to grant a compulsory license under the copyright, to any applicant therefor, subject to all of the following terms and conditions, and all of the following circumstances:

''(1) The applicant has purchased a semiconductor chip product made or distributed in violation of the owner's exclusive rights under section 106.

''(2) When the applicant first purchased such semiconductor chip product (hereinafter in this section referred to as the 'infringing product'), the applicant did not have actual knowledge that or reasonable grounds to believe that the infringing product was an infringing product (hereinafter in this section referred to as 'having notice of infringement').

''(3) The applicant, before having notice of infringement, committed substantial funds to the use of the infringing product; the applicant would suffer substantial out-of-pocket losses (other than the difference in price between the infringing product and a noninfringing product) if denied the use of the infringing product; and it would be inequitable in the circumstances not to permit the applicant to continue the use or proposed use of the infringing product.

''(4) The applicant offers, subject to the applicant's rights, if any, under section 501 (e) of this title, to pay the copyright owner a reasonable royalty for infringing products.

''(5) The royalty shall be for each unit of the infringing product distributed or used by the applicant after having notice of infringement.

''(6) The license shall be one to make and have made (but only if the copyright owner and the owner's licensees, if any, are unable to supply the applicant at a reasonable price), use, and distribute the infringing product, for substantially the same purposes that gave rise to the applicant's right to a compulsory license, throughout the United States, for the life of the copyright, revocable [only] for failure to make timely payments of royalties or other default under a license granted pursuant to this Section 119.''.

(b) The chapter analysis for chapter 1 of title 17 is amended by adding at the end thereof the following:

''119. Scope of exclusive rights: Compulsory licensing with respect to mask works.''.

DURATION OF COPYRIGHT

Sec. 6. Section 302 of title 17 of the United States Code is amended by adding at the end thereof the following:

''(f) Masks.—Copyright in mask works endures for a term of ten years from the first authorized--

''(1) distribution;

''(2) use in a commercial product; or

''(3) manufacture in commercial quantities

of semiconductor chip products made as described in subparagraph (C) or (D) of paragraph (6) of section 106.''.

INNOCENT INFRINGEMENT

Sec. 7. Section 501 of title 17 of the United States Code is amended by adding at the end thereof the following:

''(e) Notwithstanding any other provision of this chapter, a purchaser of a semiconductor chip product who purchased it in good faith, without having notice of infringement (as that term is used in section 119 of this title), shall not be liable as an infringer or otherwise be liable or subject to remedies under this chapter with respect to the use or distribution of units of such semiconductor chip product that occurred before such purchaser had notice of infringement.''.

IMPOUNDING AND SEIZURE

Sec. 8. Sections 503 (a), 503 (b), and 509 (a) of title 17 of the United States Code are each amended by inserting ''masks,'' after ''film negatives,'' each place it appears.

EFFECTIVE DATE

Sec. 9. The amendments made by this Act shall take effect ninety days after the date of enactment of this Act, but shall not apply to--

(1) semiconductor chip products manufactured in the United States or imported into the United States before the effective date;

(2) masks made in the United States or imported into the United States before the effective date; or

(3) semiconductor chip products manufactured in the United States by means of masks described in paragraph (2) of this section.

THE
ASSOCIATION
OF DATA
PROCESSING
SERVICE
ORGANIZATIONS

OFFICE OF THE
GENERAL COUNSEL

October 31, 1983

Michael Remington, Counsel
Subcommittee on Courts, Civil Liberties, and
 the Administration of Justice
2137 Rayburn House Office Building
Washington, D.C. 20515

Dear Mike:

Enclosed as requested is ADAPSO's Statement regarding S. 1201, the Semiconductor Chip Protection Act of 1983. Insofar as H.R. 1028 parallels S. 1201, the same comments would apply.

If we may be of additional help, please do not hesitate to call.

Sincerely yours,

Ron Palenski

Ronald J. Palenski
Associate General Counsel

1300 NORTH SEVENTEENTH STREET ARLINGTON, VIRGINIA 22209 (703) 522-5055

STATEMENT OF

OSCAR H. SCHACHTER

OF THE

THE ASSOCIATION OF DATA PROCESSING

SERVICE ORGANIZATIONS, INC.

ON

S. 1201

"SEMICONDUCTOR CHIP PROTECTION ACT OF 1983"

May 19, 1983

Good Morning. My name is Oscar Schachter, and I am President of Advanced Computer Techniques Corporation, a computer services and software product company. I will represent the position of the Association of Data Processing Service Organizations (ADAPSO) with regard to the provisions of proposed S. 1201, cited as the "Semiconductor Chip Protection Act of 1983."

Although ADAPSO represents principally the interests of computer service and software product companies, ADAPSO's members are vitally interested in the protection afforded to semiconductor chips which are a component of computer hardware. Many member companies of ADAPSO sell packages comprised of their own software and other companies' hardware. ADAPSO member companies develop software intended to operate with specific semiconductor chips. They also use computers and other electronic devices containing chips in providing data processing services to their customers. They are therefore concerned about the protection afforded semiconductor chips, as well as the provisions of proposed S. 1201 relating to compulsory licensing.

It is ADAPSO's position that it is important to provide for semiconductor chips the protection which such vital components of our technology industry require. Such protection is also needed to maintain the necessary incentive for their further development and enhancement. ADAPSO further agrees that it is necessary to provide such protection while avoiding the imposition of punitive liability on users who were unaware of having purchased infringing semiconductor chips and who invested substantial amounts in manufacturing or operating equipment using these chips. ADAPSO does not however believe that an amendment of the Copyright Act, such as that proposed by S. 1201 is the best means of providing the protection needed by semiconductor chips.

It is ADAPSO's position that a new form of protection should be considered for semiconductor chips. Enactment of S. 1201 would introduce a variety of new concepts into the basic copyright structure with the effect of raising Constitutional and other questions regarding their validity in the context of traditional copyright law.

Some of the principal points ADAPSO would like to raise with regard to the proposed bill are:

1. Legislating that a semiconductor chip product is "a writing" (bill, sec. 2, p. 2, line 8) does not necessarily make it one. There is substantial doubt whether the Constitution and case law will support this interpretation.

2. The same question exists whether a chip is "a discovery," as the bill (loc. cit.) also provides. If it is, it may not be

protected by reason of 17 U.S.C. sec. 102(b) which denies copyright protection to any ". . . system, method of operation . . . or discovery," etc. The fundamental idea/expression dichotomy which is a basic premise of copyright law is brought into question by making a "discovery" copyrightable.

3. If a chip is a "discovery" and protected by copyright law, the entire question of preemption of trade secret law by copyright is further complicated. A misappropriator of any trade secret in the chip "discovery" might be able to argue preemption more effectively than is now possible. Although most authorities have expressed the view that sec. 301 (the preemption section) of the present Copyright Act does not preempt trade secret protection, the bill might raise basic, and complex, questions in the relationship of the proposed statutory amendment to trade secret law.

4. It is not clear whether protection under the bill would make it an infringement for a third party to reverse engineer the chip, even if the third party "uses" only what the chip discloses as to unpatented methods, systems or ideas, (traditionally all unprotected under copyright) embodied in the chip and does not "use" from the chip embodiment any expression which is traditionally protected under copyright.

5. Another basic problem is the bill's creation of entirely new basic rights in the context of copyright law. For example

among the new categories of copyright rights which the bill would enact would be rights such as exclusive rights to "use" a mask to make a chip and to "use" the chip itself (bill, sec. 4(3), p. 4, lines 1-2, 8-10). A "use" right is not presently a right which the Copyright Act provides under 17 U.S.C. sec. 106 for any other category of work.

6. In addition to enacting an "exclusive right . . . to use," the bill would add basic concepts and terminology heretofore unknown to the Copyright Act — such as a right "to embody" (a mask work in a mask) (bill, sec. 4, p. 3, line 23) and a right "substantially to reproduce" (images of a mask work) (bill, sec. 4, p. 4, line 4). The new right "substantially to reproduce" would be in addition to, and not in lieu of, the existing right under 17 U.S.C. sec. 106(1) "to reproduce."

7. The substance of the basic rights which the bill would provide to chip proprietors are those largely analogous to the patent rights to make, use and sell, not the traditional copyright rights (bill, sec. 4, p. 3, line 22 to p. 4, line 10).

8. The bill presumably would not make independent creation of a mask or chip an infringement. However, it should be noted that any "discovery" (bill, sec. 2, p. 2, line 8), ideas, etc. which are protected against "use" would be given such protection without having to meet any novelty requirement.

9. The bill (sec. 2, p. 3, lines 3-6) selectively permits the term "copy" to apply to chips only under a limited number of sections of the Copyright Act (and presumably no others) where that term now appears. Such legislation would add a gray third category to what is otherwise a reasonably clear division of tangible fixations of works into only two categories throughout the entire Act: "copies" and "phonorecords."

10. Computer programs and data bases often reside in chips. The bill may inadvertently sweep into its compulsory licensing scheme these copyrighted works.

11. The copyright term under the bill would be computed differently from that of all other works under the Copyright Act as well as being of a different duration. The creation of such new concepts and provisions as part of a very traditional body of law must be given very careful consideration.

It appears to ADAPSO that the above points raise a substantial question whether the agreed upon need for protection of semiconductor chips is best served through a proposed amendment of the Copyright Act. We believe that additional consideration must be given this question before specific refinements of the language of the proposed legislation are addressed.

OSCAR H. SCHACHTER

Education

Harvard Law School, J.D. 1957.

New York University - Graduate courses in accounting, taxation, and corporate finance.

Experience

Advanced Computer Techniques Corporation - Computer Services and Software Products Business.

President - 1982 to Present
Executive Vice President and General Counsel - 1966 to 1981

Professional Memberships

Legal

American Bar Association

Bar Association of the City of New York
- Member, Computer Law Committee
- Subcommittee Chairman, Software Protection Committee

Industry

Association of Data Processing Organizations
- Former Chairman, International Committee
- Chairman, Vendor Relations Committee
- Member of Board of Directors, Software Products Section and Professional Services Section

Software Industry Association
- Vice President, Software Products Section

Keynote Speaker, Japanese Software Industry Association Meeting - 1980.

Speaker, Practicing Law Institute Conference on Computer Law

Co-Chairman, United States, for First International Meeting for Data Processing Orgaanizations - Barcelona, 1978.

Seminar Chairman, Legal aspects of Computer License Agreements - Barcelona, 1978.

SEMICONDUCTOR RESEARCH CORPORATION

COOPERATIVE
RESEARCH

October 31, 1983

The Honorable Robert W. Kastenmeier
Chairman
Subcommittee on Courts, Civil Liberties
and the Administration of Justice
2137 Rayburn House Office Building
Washington, DC 20515

Dear Congressman Kastenmeier:

Your subcommittee is currently considering the Semiconductor Chip Protection Act of 1983 (H.R. 1028) sponsored by Rep. Don Edwards. I write on behalf of the Semiconductor Research Corporation to express our appreciation of your efforts to hold hearings on this bill and to urge you to support this essential legislation and move it on to speedy enactment.

One of the major goals of the cooperative research currently sponsored by SIA member companies through the Semiconductor Research Corporation is the capability to automatically design semiconductor chips that represent the integration of literally millions of transistors onto a "chip" of silicon that is wafer-thin and about one quarter of an inch square. Manually, this task represents hundreds of thousands of man hours which is prohibitively expensive. The investment in research to automate the design process is negated if copyright protection is not granted under the law.

As a formal statement of our position, we ask that this letter be entered into the record of your hearings on H.R. 1028.

Sincerely,

Larry W. Sumney
Executive Director

LWS:mpr

cc: Rep. Ed Zschau
Rep. Don Edwards

300 PARK DRIVE, SUITE 215 • P.O. BOX 12053 • RESEARCH TRIANGLE PARK, N.C. 27709 • (919) 549-9333

American Electronics Association
Government Operations Office

AEA

1612 K Street N.W.
Washington, D.C 20006

(202) 331-8050

November 1, 1983

The Honorable Robert Kastenmeier
Chairman
Subcommittee on Courts, Civil Liberties and the
Administration of Justice
Room B-2137, Rayburn House Office Building
Washington, D.C. 20515

Dear Chairman Kastenmeier:

The American Electronics Association (AEA) supports the passage of H.R.1028, the Semiconductor Chip Protection Act of 1983. AEA represents over 2,300 member companies nationwide, and over 450 financial, legal and accounting organizations which participate as associate members. AEA companies account for 63 percent of the worldwide sales of U.S. based electronics companies. Approximately 72 percent of AEA companies are small businesses employing fewer than 200 people; and twelve percent are large companies employing more than 1000 people.

For the electronics industry to remain competitive, it is imperative that semiconductor designers have legal protection from pirate firms that copy their designs. H.R.1028 would give semiconductors designers the protection necessary to continue the innovative progress that has contributed to the success of our industry.

Passage of H.R.1028 is particularly important at a time when new generations of semiconductor products will soon enter the market. Semiconductors must have legal protections as soon as possible if America is to keep its edge in the electronics field.

AEA encourages your subcommittee to hold additional hearings on this legislation so that it can be further discussed and hopefully be passed as expeditiously as possible.

Sincerely yours,

Kenneth C.O. Hagerty
Vice President,
Government Operations

GENERAL ELECTRIC

SEMICONDUCTOR BUSINESS DIVISION
GENERAL ELECTRIC COMPANY • ONE MICRON DRIVE • RESEARCH TRIANGLE PARK, NC 27709 • (919) 549-3100

October 20, 1983

The Honorable Robert W. Kastenmeier
Chairman
Subcommittee on Courts, Civil Liberties
and the Administration of Justice
2137 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Kastenmeier:

The General Electric Company appreciates your Subcommittee's consideration of H.R. 1028, the Semiconductor Chip Protection Act of 1983, and would like to add our support of the bill to the record of the hearings you have chaired.

This bill is one which is particularly important at a time when a new generation of semiconductor products will soon enter the market. If these new chips are copied, it will cost the U.S. industry tens of millions of dollars per year and will certainly deter future innovation.

We hope you will support H.R. 1028. With your support, the bill can soon begin to provide protection to firms in our industry.

Sincerely,

James E. Dykes
Vice President and General Manager

JED:rpr

cc: Rep. Don Edwards
Rep. Tim Valentine

University of
Nebraska
Lincoln

College of Law

Lincoln, NE 68583-0902
(402) 472-2161

November 27, 1983

The Honorable Robert W. Kastenmeier
House of Representatives
Washington, DC 20515

Dear Mr. Kastenmeier:

Thank you for your invitation to comment on H.R. 1028 and related proposals to prohibit the unauthorized duplication of semiconductor chips and masks.

I must begin by stating that I have nothing to contribute on what is of course the most fundamental question raised by these proposals--whether it is in fact wise to extend protection to such works. That decision must rest upon assessments of the extent to which economic incentive is threatened by unauthorized duplication, and of the burdens imposed by such protection in the form of increased costs and prices. I have no basis on which to assess the desirability of protection for semiconductor chips and masks, and thus confine my comments to the narrower issues raised by the attempt in H.R. 1028 to extend protection by incorporating these works within the scope of copyright.

As an initial matter, I would like to offer a comment on the question of retroactivity. Although H.R. 1028 would not impose liability for acts occurring before its effective date, it does appear to extend protection to pre-existing mask works with respect to post-enactment infringements. It must be remembered that the constitutional clause authorizing federal legislation concerning copyrights and patents grants Congress the power "To promote the Progress of Science and useful Arts." In Graham v. John Deere Co., a case involving federal patent law, the Supreme Court noted that the clause is both a grant of power and a limitation, and that its exercise "may not overreach the restraints imposed by the stated constitutional purpose." The Court specifically indicated that Congress could not authorize patents that "restrict free access to materials already available." It is possible that retroactive protection for existing mask works may be beyond Congressional authority, since the incentive function of federal protection cannot justify the recognition of property rights in pre-existing works. When faced with similar issues in connection with the extension of copyright protection to sound recordings, the Congress chose to avoid this constitutional issue by expressly excluding recordings fixed before the effective date of the amendment. The limitations of the patent and copyright clause, however, might be overcome by resting protection for

The Honorable Robert W. Kastenmeier
November 27, 1983
Page 2

pre-existing mask works on the commerce clause. But there remains the danger that abandoning the long-standing tradition against retroactive protection for writings and discoveries would encourage others to also seek similar monopolies for past contributions that should rightly remain in the public domain.

If protection of the scope afforded by H.R. 1028 to semiconductor chips and masks is indeed appropriate, I would urge the Committee to give serious consideration to the enactment of separate legislation specifically tailored to the unique requirements of such works. The restrictions embodied in H.R. 1028 go far beyond the traditional copyright monopoly. Both Congress and the courts have taken pains to insure that copyright protection has not interfered with free access to useful articles. Section 101 of the Copyright Act specifically limits protection to features of useful articles that can be separated from the utilitarian aspects of the work, and section 113(b) further insures that copyright will not inhibit the production of useful articles. The fact that manufacturers consider inadequate the limited protection currently available for masks as pictorial or graphic works under present copyright law itself illustrates that the restrictions they seek go beyond the traditional limits of copyright. Indeed, the protection extended by H.R. 1028 could not easily be accommodated within the structure of the design protection legislation that has long been before Congress, most recently as H.R. 2985. While overcoming some of the limitations with respect to copyright in useful articles, these bills have always been limited to the ornamental aspects of utilitarian objects.

H.R. 1028 appears to provide the designer of a semiconductor chip a monopoly over its production, distribution and use. Only patent law has previously conferred such a right in utilitarian articles. The exclusive right to "use" a mask or chip embodying the mask work extends beyond any right traditionally considered within the scope of copyright. If protection of this magnitude is indeed necessary, separate semiconductor chip legislation would provide an opportunity to formulate the desired monopoly without the encumbrance of traditional copyright limitations, many of which are judicial doctrines not expressly contained in the Copyright Act. It would also prevent distortion of copyright concepts applicable to more traditional subject matter.

I would like to offer two comments on specific provisions of H.R. 1028. In section 2, the definition of a "semiconductor chip product" requires that the product be a "writing" or "discovery" or that its use "affects commerce." This would require the courts in every application of the act involving such objects to make a constitutional determination as to the scope of the respective constitutional clauses. Particularly with respect to the copyright and patent clause, this approach has consistently been avoided in favor of an express or implicit Congressional finding that the category of work at issue lies within the scope of its authority. This permits a final judicial determination of the constitutionality of the

The Honorable Robert W Kastenmeier
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Page 3

legislation, eliminating the necessity of reconsidering the constitutional issue on a case by case basis. In addition, since it is the mask work that is the subject of protection, it is to that work rather than the semiconductor chip that the constitutional standard must be applied. Finally, it is not entirely clear from the present language of the bill whether the exclusive right to "embody the mask work in a mask", or the other exclusive rights involving a "mask embodying the mask work", are meant to extend only to instances in which the protected work is copied, as is the rule under copyright law, or are instead intended to apply to all masks that embody a mask work substantially similar to the protected work, even if independently created, as in the rule under patent law. If protection is incorporated within the copyright system, the former interpretation will presumably be invoked, but in the event the bill is enacted as independent legislation, a clearer statement of intent may be desirable.

Again, thank you for the opportunity to comment on these proposals.

Sincerely,

Robert C. Denicola

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In the event it might be of some interest I've enclosed an article I recently published on the issue of copyright protection for useful articles.

R.C.D.

APPLIED ART AND INDUSTRIAL DESIGN: A SUGGESTED APPROACH TO COPYRIGHT IN USEFUL ARTICLES

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Applied Art and Industrial Design: A Suggested Approach to Copyright in Useful Articles

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The word "copyright" evokes images of books, movies, or sound recordings. Further reflection might yield visions of paintings, photographs, or sculptural works. Few, however, associate copyright with belt buckles, table lamps, or pencil sharpeners—yet to some unsettled extent, even these items have their place in the copyright scheme.

Copyright law has reluctantly embraced a variety of works embodied in utilitarian objects, while simultaneously purporting to exclude the general province of industrial design. The courts have concluded that a light bulb protruding from Michelangelo's *David* ought not render the statue unprotectible,[1] while insisting that the overall design of modern street lights lies beyond the scope of copyright protection.[2] The grudging inclusion of selected useful objects has led both Congress and the courts to seek a rationale that could stand fast against the deluge of mass-produced industrial goods. Although the search has not gone well, the decision to exclude the general appearance of commercial products from copyright protection remains unshaken.[3] The result has been a patchwork of ad hoc decisions, united only by their common references to statutory formulations that do little more than restate the dilemma.

The legal status of commercial design, however, is only partially fixed by copyright principles. Design patents[4] long of-

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1. *See* Mazer v. Stein, 347 U.S. 201 (1954).

2. *See* Esquire, Inc. v. Ringer, 591 F.2d 796 (D.C. Cir. 1978), *cert. denied*, 440 U.S. 908 (1979).

3. *See* 17 U.S.C. § 101 (1976) (definition of "pictorial, graphic, and sculptural works"). "The Committee has added language to the definition of 'pictorial, graphic, and sculptural works' in an effort to make clearer the distinction between works of applied art protectable under the bill and industrial designs not subject to copyright protection." H.R. REP. No. 1476, 94th Cong., 2d Sess. 54 (1976), *reprinted in* 1976 U.S. CODE CONG. & AD. NEWS 5659-5801 [hereinafter cited as H.R. REP. No. 1476].

4. *See* 35 U.S.C. § 171 (1976).

fered the possibility of protection for the ornamental design of a useful product. Their integration into a general patent regime directed primarily at mechanical rather than aesthetic innovation, however, severely undermined their practical utility.[5] Consequently, alternative proposals have become a congressional fixture,[6] spawning a raft of conflicting academic analysis.[7] The failure to win more specialized protection has encouraged efforts to assimilate design protection into the law of copyright. Indeed, even passage of a sui generis design statute would do little to deflect attempts to secure the more expansive monopoly offered by copyright.[8]

This Article examines the current status of useful articles under the Copyright Act of 1976[9] and proposes an alternative analysis of their copyrightability. Congress, borrowing heavily from prior administrative and judicial formulations, has constructed an elaborate mechanism to differentiate protectible "applied art" from unprotectible "industrial design." Thus, the Act rejects both wholesale inclusion and exclusion of utilitarian objects, leaving it to the courts to define and defend a middle ground. Against the backdrop of Justice Holmes's admonition to avoid judicial determinations of artistic merit or worth,[10]

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5. *See infra* note 30.

6. *See, e.g.*, S. 22, tit. II, 94th Cong., 1st Sess. §§ 201-235, 122 CONG. REC. 3856-59 (1975), *reprinted in* S. REP. No. 473, 94th Cong., 1st Sess. 39-47 (1975) [hereinafter cited as S. 22, tit. II]. Counting unsuccessful design protection bills has become a popular pastime. *See* In re Nalbandian, 661 F.2d 1214, 1218 n.1 (C.C.P.A. 1981) (Rich, J., concurring) ("Records I made in the mid 50's show that, beginning in 1914, some 45 bills were introduced . . . ."); Dulin, *Design Protection: Walking the Pirate Plank?*, 12 BULL. COPYRIGHT SOC'Y 321, 325 (1965) ("In the fifty years since 1914, 55 design protection bills have been introduced . . . ."); Note, *Protection for the Artistic Aspects of Articles of Utility*, 72 HARV. L. REV. 1520, 1520 (1959) ("to date more than thirty-five such bills have been unsuccessfully introduced"); Comment, *Trade Regulation: Legal Protection of Commercial Design*, 1959 WIS. L. REV. 652, 662 ("During the period of 1914 to 1959, forty-eight bills were introduced . . . ."). "Since 1914, approximately seventy design protection bills have been introduced in Congress, none of which has been enacted into law." Esquire, Inc. v. Ringer, 591 F.2d 796, 800 n.12 (D.C. Cir. 1978), *cert. denied*, 440 U.S. 908 (1979). The list continues to grow. *See* H.R. 20, 97th Cong., 1st Sess. (1981), *reprinted in* 2 COPYRIGHT L. REP. (CCH) ¶ 20,097 (1981).

7. The more recent articles are noted and summarized in COPYRIGHT OFFICE, BIBLIOGRAPHY ON DESIGN PROTECTION (Supp. 1976).

8. Recent design protection bills have carefully preserved the proprietor's right to rely on the copyright alternative. *See, e.g.*, H.R. 20, 97th Cong., 1st Sess. § 927 (1981), *reprinted in* 2 COPYRIGHT L. REP. (CCH) ¶ 20,097 (1981); S. 22, tit. II, *supra* note 6, § 227.

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

10. It would be a dangerous undertaking for persons trained only to the law to constitute themselves final judges of the worth of pictorial illustrations, outside of the narrowest and most obvious limits. At the

however, few touchstones developed. Yet, a discriminating approach is both defensible and desirable. Industrial design differs in important respects from the traditional subject matters of copyright, and presents a less compelling claim to the statutory monopoly. But it is unwise, if not in fact impossible, to exclude from the scope of copyright all works capable of serving some useful purpose. The attempts of the Congress, the Copyright Office, and the courts to delimit the boundaries of copyright in useful articles have been only partially successful. Their efforts have a transient quality conspicuous even in a legal regime populated by concepts as ephemeral as "idea," "expression," and "creativity." A good portion of the difficulty arises from the tendency to focus exclusively on the *results* of the creative effort. This Article suggests that it is the *process* of creation that distinguishes industrial design from applied art and other forms of authorship traditionally recognized by copyright law.

I. INITIAL ENCOUNTERS

The uneasy relationship between copyright and utilitarian articles has its roots in a series of piecemeal additions to the statutory subject matter. The constitutional provision authorizing federal copyright legislation, with its reference to "Authors" and their "Writings," gives little hint of the scope of modern copyright law.[11] The initial exercise of the copyright power in 1790 was confined to maps, charts, and books.[12] In 1802, coverage was extended to "prints."[13] Musical compositions were brought within the statutory framework in 1831,[14] and photo-

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> one extreme, some works of genius would be sure to miss appreciation. Their very novelty would make them repulsive until the public had learned the new language in which their author spoke. It may be more than doubted, for instance, whether the etchings of Goya or the paintings of Manet would have been sure of protection when seen for the first time. At the other end, copyright would be denied to pictures which appealed to a public less educated than the judge.

Bleistein v. Donaldson Lithographing Co., 188 U.S. 239, 251-52 (1903) (Holmes, J.). *See* Mazer v. Stein, 347 U.S. 201, 214 (1954) ("Individual perception of the beautiful is too varied a power to permit a narrow or rigid concept of art.").

11. U.S. CONST. art. I, § 8, cl. 8. *See generally* W. DERENBERG, THE MEANING OF "WRITINGS" IN THE COPYRIGHT CLAUSE OF THE CONSTITUTION (Copyright Office Study No. 3, 1956), *reprinted in* 1 STUDIES ON COPYRIGHT 43 (Copyright Soc'y of the U.S.A. ed. 1963).

12. *See* Act of May 31, 1790, ch. 15, 1 Stat. 124 (current version at 17 U.S.C. §§ 101-810 (1976)).

13. Act of Apr. 29, 1802, ch. 36, 2 Stat. 171 (repealed 1813).

14. Act of Feb. 3, 1831, ch. 16, 4 Stat. 436 (repealed 1870).

graphs followed in 1865.[15] Not until 1870, when protection was extended to "painting, drawing, chromo, statue, statuary, and of models or designs intended to be perfected as works of the fine arts,"[16] did three-dimensional objects gain protection. The emphasis on "fine arts," however, served to maintain a respectable distance between copyright and useful articles. Under the Copyright Act of 1909,[17] the immediate precursor of the current statute, however, claims of copyright in utilitarian objects could not be so easily dismissed.

Among the items eligible for copyright under the 1909 Act were those specified in section 5(g): "Works of art; models or designs for works of art."[18] With the deletion of all reference to the "fine arts," a major barrier to copyright in the design of useful objects apparently fell. No logic could demonstrate that crystal wine glasses, pearl rings, or even handsome radio cabinets were not "works of art." The Copyright Office,[19] however, quickly moved to exclude useful articles from the scope of copyright by resurrecting the very distinction so recently abandoned by the Congress. In a 1910 regulation defining "works of art," the Copyright Office restricted the newly established classification to "the so-called fine arts," expressly excluding "[p]roductions of the industrial arts utilitarian in purpose and character."[20]

The "industrial arts," however, proved difficult to contain. In 1917, the Copyright Office amended the regulation to permit registration of "artistic drawings notwithstanding they may afterwards be utilized for articles of manufacture."[21] By 1949, the breach was significantly wider: "This class includes published

15. Act of Mar. 3, 1865, ch. 126, 13 Stat. 540 (repealed 1870).

16. Act of July 8, 1870, ch. 230, § 86, 16 Stat. 198, 212 (repealed 1916).

17. Act of Mar. 4, 1909, ch. 320, 35 Stat. 1077 (current version at 17 U.S.C. § 102 (1976)).

18. *Id.* § 5(g).

19. The Copyright Office, under the direction of the Register of Copyrights, is responsible for all administrative functions and duties under the Copyright Act. 17 U.S.C. § 701 (1976). The Register of Copyrights is authorized to establish regulations for the administration of the Copyright Act. 17 U.S.C. § 702 (1976).

20. *Works of Art.* This term includes all works belonging fairly to the so-called fine arts. (Paintings, drawings, and sculpture).

> Productions of the industrial arts utilitarian in purpose and character are not subject to copyright registration, even if artistically made or ornamented. No copyright exists in toys, games, dolls, advertising, novelties, instruments or tools of any kind, glassware, embroideries, garments, laces, woven fabrics, or any smaller articles.

COPYRIGHT OFFICE, RULES AND REGULATIONS FOR THE REGISTRATION OF CLAIMS TO COPYRIGHT, BULL. No. 15, § 12(g) (1910).

21. 37 C.F.R. § 201.4(7) (1917).

or unpublished works of artistic craftsmanship, insofar as their form but not their mechanical or utilitarian aspects are concerned, such as artistic jewelry, enamels, glassware, and tapestries, as well as works belonging to the fine arts . . . ."[22] Forty years after Congress had forsaken the limitation, the Copyright Office formally abandoned the attempt to restrict the reach of copyright to works of the "fine arts." A reference to "works of artistic craftsmanship" was all that remained of the barrier between copyright and the design of utilitarian products. Attention then shifted from administrative to judicial formulations.

In 1954, the United States Supreme Court considered a copyright infringement claim involving china statuettes of Balinese dancing figures. The contestants in *Mazer v. Stein*[23] were rival lamp manufacturers. The copyright owner, with the addition of the appropriate hardware, employed the statuettes as bases for table lamps. The statuettes, *sans* sockets and wiring, were registered with the Copyright Office as "works of art" and "reproductions of a work of art."[24] A competitor copied the figures and put them to a similar use.

The defendants premised their response to the charge of infringement chiefly on the federal design patent law, which protects "any new, original and ornamental design for an article of manufacture."[25] Only design patents, they argued, could monopolize the appearance of mass-produced utilitarian articles. The Court did not agree: "Neither the Copyright Statute nor any other says that because a thing is patentable it may not be copyrighted. We should not so hold."[26] The contention that useful articles were beyond the limits of copyright was formally put to rest:

> The dichotomy of protection for the aesthetic is not beauty and utility but art for the copyright and the invention of original and ornamental design for design patents. 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. We do not read such a limitation into the copyright law.[27]

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22. 37 C.F.R. § 202.10(a) (1949).
23. 347 U.S. 201 (1954).
24. *See* Copyright Act of 1909, ch. 320, §§ 5(g), 5(h), 35 Stat. 1077 (current version at 17 U.S.C. § 102 (1976)).
25. 35 U.S.C. § 171 (1976). *See infra* note 30.
26. 347 U.S. at 217.
27. *Id.* at 218. The Copyright Office had by this time registered a variety of utilitarian articles, including "book ends, clocks, lamps, door knockers, candlesticks, inkstands, chandeliers, piggy banks, sundials, salt and pepper shakers, fish bowls, casseroles, and ash trays." *Id.* at 221 (Douglas, J., concurring). Some of these items, however, may not be protected under the more intricate standard currently in effect. *See infra* notes 71-76 and accompanying text.

Mazer, however, fell far short of a wholesale endorsement of copyright in the design of useful objects. The Court was quick to point out the narrow issue for decision: "The case requires an answer, not as to a manufacturer's right to register a lamp base but as to an artist's right to copyright a work of art intended to be reproduced for lamp bases."[28] The statuettes, as works of art, were entitled to copyright. Neither prior nor subsequent use in utilitarian articles, nor the fact that they were conceived expressly for such an end, jeopardized that status. Utility and art were no longer mutually exclusive, but it was still only the latter that could command copyright. *Mazer* answered one question, yet wisely eschewed another. The use to which "works of art" are put is irrelevant, the Court declared, but the bounds of that statutory classification remained uncertain. A dancing figure qualified, but the Court had said nothing of the forms displayed by toasters or automobiles, or the designs of wedding gowns or belt buckles.

Those seeking protection for the full range of industrial design could find comfort in the Court's echo of Justice Holmes: "Individual perception of the beautiful is too varied a power to permit a narrow or rigid concept of art."[29] Yet to apply the statutory criterion, *some* conception of art, or more precisely some conception of section 5(g) "works of art," remained a necessity. Most of the suggested models, however, did not assimilate industrial design.

Tests emphasizing aesthetic merit had little to recommend them. The "inventiveness" criterion of federal design patent law imposed a similar analysis in that regime with disastrous results.[30] In the copyright sphere, most judges prudently

28. 347 U.S. at 205.

29. *Id.* at 214.

30. Since 1842, federal patent law has made express provision for the protection of ornamental designs. *See* Act of Aug. 29, 1842, ch. 263, 5 Stat. 544 (current version at 35 U.S.C. § 171 (1976)). Patents have issued for the design of objects ranging from hosiery reinforcements, Glen Raven Knitting Mills, Inc. v. Sanson Hosiery Mills, Inc., 189 F.2d 845 (4th Cir. 1951), to concrete mixer trucks, *In re* Koehring, 37 F.2d 421 (C.C.P.A. 1930). *See* C.F. Mueller Co. v. A. Zeregas Sons, 12 F.2d 517 (2d Cir. 1926) (design patent on noodle shape invalid). Current law provides: "Whoever invents any new, original and ornamental design for an article of manufacture may obtain a patent therefor, subject to the conditions and requirements of this title. The provisions of this title relating to patents for inventions shall apply to patents for designs, except as otherwise provided." 35 U.S.C. § 171 (1976).

The overlap between the subject matters of design patent and copyright raises the possibility of dual protection. Early case law put the creator to an election. *See, e.g., In re* Blood, 23 F.2d 772, 772 (D.C. Cir. 1927) (hosiery ticket); Louis De Jonge & Co. v. Breuker & Kessler Co., 182 F. 150, 152 (E.D. Pa. 1910)

(Christmas wrapping paper) (dicta), *aff'd on other grounds*, 191 F. 35 (3d Cir. 1911), *aff'd*, 235 U.S. 33 (1914). The Supreme Court in Mazer v. Stein, 347 U.S. 201, 217 (1954), noted the prior case law, but found it unnecessary to consider the election doctrine, because the plaintiff had not sought design patent protection. In 1974, the Court of Customs and Patent Appeals repudiated the concept of election in reversing a Patent and Trademark Office decision to reject a patent application for a previously copyrighted Spiro Agnew watch. *In re* Yardley, 493 F.2d 1389, 1394 (C.C.P.A. 1974). The Copyright Office, however, continues to refuse registration once a design patent has issued. 37 C.F.R. § 202.10(a) (1981). The position appears difficult to rationalize in view of section 102(a) of the Copyright Act, 17 U.S.C. § 102(a) (1976), which provides that copyright "subsists" in works "fixed in any tangible medium of expression." *See* Frijouf, *Simultaneous Copyright and Patent Protection*, 23 COPYRIGHT L. SYMP. 99, 109-11 (1977); Note, *Functional Works of Art: Copyright, Design Patent, or Both?*, 3 COMM/ENT L.J. 83, 102-03 (1980).

Unlike copyright, with its modest requirements of originality, generally understood to be "little more than a prohibition of actual copying," Alfred Bell & Co. v. Catalda Fine Arts, Inc., 191 F.2d 99, 103 (2d Cir. 1951) (quoting Hoague-Sprague Corp. v. Frank C. Meyer Co., 31 F.2d 583, 586 (E.D.N.Y. 1929)), and some minimal degree of creativity or effort, *see* Denicola, *Copyright in Collections of Facts: A Theory for the Protection of Nonfiction Literary Works*, 81 COLUM. L. REV. 516, 520-22 (1981), the barriers to design protection are imposing. As a result of the novelty requirement, independent creation is not sufficient. Rather, the design must produce a new visual impression, generally measured with reference to an ordinary observer. *See* 2 A. DELLER, WALKER ON PATENTS § 159 (1964). The design must also be "ornamental," thus necessitating at least a minimal assessment of its aesthetic impact. *Id.* § 160.

The reference in section 171 of the design patent law to provisions relating to inventions, however, introduces a more troublesome requirement. *See* 35 U.S.C. § 171 (1976). Section 103 of the patent statute prohibits the issuance of a patent when "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." 35 U.S.C. § 103 (1976). The "nonobviousness" test is a 1952 codification of the "inventiveness" standard generally applied to applications for both mechanical and design patents. *See* 2 A. DELLER, *supra*, § 161. Whatever utility the standard may have with respect to mechanical patents, however, it has been little short of ruinous in the design patent regime.

On a doctrinal level, application of the "person having ordinary skill in the art" standard in the design context has generated a semantic dispute between proponents of an "ordinary observer" standard and those who advocate an "ordinary designer" benchmark. *See In re* Nalbandian, 661 F.2d 1214, 1216-17 (C.C.P.A. 1981) (reviewing the conflicting case law). One suspects that the semantics have little substantive impact. "It is probably true . . . that . . . courts will, with phraseology of their own choosing, continue to find designs patentable or unpatentable according to their judicial 'hunches.' ". *Id.* at 1218 (Rich, J., concurring). On a more fundamental level, an obviousness test for aesthetic contributions appears to demand the very artistic judgments and analysis wisely shunned by copyright law. *But cf.* Belding Heminway Co. v. Future Fashions, Inc., 143 F.2d 216, 217-18 (2d Cir. 1944) ("That there may be as outstanding aesthetic invention as there is mechanical, only barbarians would deny." Unfortunately, the barbarians cannot be relied on to recuse themselves.). The Commissioner of Patents and Trademarks has acknowledged that "the concept of unobviousness is not well suited to ornamental designs." Address by Commissioner of Patents and Trademarks Gerald Mossinghoff, ABA shunned the role of art critic.[31] A more appealing approach was to turn to history in an attempt to cabin the reach of copyright. In one of the series of cases brought by the plaintiff in *Mazer*, the Ninth Circuit stated, "A thing is a work of art if it appears to be within the historical and ordinary conception of the term art."[32] The rationale admitted statuettes, but excluded a cardboard photo holder.[33] Although this formulation was perhaps an improvement over purely subjective evaluations of artistic merit, as a practical matter it could furnish little guidance in specific cases. With museums proudly displaying the pottery, weapons, furnishings, and other artifacts of preceding cultures, the sweep of the rationale might well exceed the expectations of its proponents. Emphasis on a "colloquial rather than a philosophical significance"[34] for

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Patent, Trademark and Copyright Law Section Meeting (Aug. 8, 1981), *quoted in In re* Nalbandian, 661 F.2d 1214, 1219 (C.C.P.A. 1981).

Reliance on so subjective a standard inevitably has its price. "In final analysis it depends upon the judgment of the judge or judges who have the last say." Gold Seal Importers, Inc. v. Morris White Fashions, Inc., 124 F.2d 141, 143 (2d Cir. 1941) (invalidating design patent for lack of inventiveness). A study by the Patent and Trademark Office indicated that an astonishing 68% of design patents challenged in federal courts during the period from 1973 to 1977 were held invalid. Patent and Trademark Office, Study of Court Determinations of Patent Validity/Invalidity, 1973-1977, *reprinted in* 455 Pat. Trademark & Copyright J. (BNA) D-1 - D-3 (1979). Although the sample produced by decisions to contest validity is undoubtedly biased toward questionable patents, the statistics clearly justify the ill repute generally attached to design patent law. The insecurity is particularly troubling in light of the effort and expense necessary to obtain issuance of a design patent.

Because of the necessity of evaluating novelty and nonobviousness, the patent application process is substantially more protracted than copyright registration procedures. In 1975, the average time between filing and issuance was reported to be about twenty-one months. Copyright Office, Second Supplementary Report of the Register of Copyrights on the General Revision of the U.S. Copyright Law: 1975 Revision Bill 187 (Draft 1975) [hereinafter cited as Second Supplementary Report]. Costs, including attorney's fees, can quickly become prohibitive for small enterprises, particularly when a number of new designs are to be introduced. It is hardly surprising that both the Copyright Office and the Patent and Trademark Office have urged the enactment of alternative design protection legislation. *Id.* at 186-87, 203; Address by Commissioner of Patents and Trademarks Gerald Mossinghoff, *supra*.

31. *See, e.g.*, Bleistein v. Donaldson Lithographing Co., 188 U.S. 239, 243 (1903) (circus poster); Rushton v. Vitale, 218 F.2d 434, 436 (2d Cir. 1955) (chimpanzee doll); Pellegrini v. Allegrini, 2 F.2d 610, 611 (E.D. Pa. 1924) (miniature religious shrine).

32. Rosenthal v. Stein, 205 F.2d 633, 635 (9th Cir. 1953).

33. *See* Bailie v. Fisher, 258 F.2d 425, 426 (D.C. Cir. 1958). The historical approach to the "works of art" classification has also been championed in the academic literature. *See* Comment, *supra* note 6, at 660.

34. Vacheron & Constantin-Le Coultre Watches Co. v. Benrus Watch Co., 155 F. Supp. 932, 934 (S.D.N.Y. 1957), *aff'd on other grounds*, 260 F.2d 637 (2d Cir. 1958).

"works of art" only transfered aesthetic judgments to a different jury. Moreover, given the selective additions to the statutory subject matter that preceded the "works of art" classification, there was no reason to suspect that the new category was intended to subsume every object that either curator or bumpkin might label "art."

In retrospect, *Mazer v. Stein* did little to clarify the issue of copyright in the design of commercial products; it merely enjoined the automatic excision of all utilitarian articles. Although the Copyright Office Regulations soon reflected the Court's narrow holding,[35] the administrative response did not end with codification. Determined to close the door that *Mazer* left ajar, the Copyright Office sought a formulation that would accommodate *Mazer,* yet exclude the general realm of industrial design. After one aborted attempt,[36] it settled on the "separability" standard that has come to dominate current analysis:

> If the sole intrinsic function of an article is its utility, the fact that the article is unique and attractively shaped will not qualify it as a work of art. However, if the shape of a utilitarian article incorporates features, such as artistic sculpture, carving, or pictorial representation, which can be identified separately and are capable of existing independently as a work of art, such features will be eligible for registration.[37]

Mazer had quickly become the limit of copyright in useful articles.

Even the guarded terms of *Mazer* and its regulatory progeny, however, brought major change. Overcoming a long-standing exclusion,[38] graphic designs adorning textiles were now securely within the subject matter of copyright.[39] The regula-

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35. In order to be acceptable as a work of art, the work must embody some creative authorship in its delineation or form. The registrability of a work of art is not affected by the intention of the author as to the use of the work, the number of copies reproduced, or the fact that it appears on a textile material or textile product. The potential availability of protection under the design patent law will not affect the registrability of a work of art . . . .

37 C.F.R. § 202.10(b) (Supp. 1956) (current version at 37 C.F.R. § 202.10(a) (1981)).

36. *See* 37 C.F.R. § 202.10(c) (Supp. 1956).

37. 37 C.F.R. § 202.10(c) (1959) (revoked Jan. 1, 1978, 43 Fed. Reg. 966 (1978)).

38. *See, e.g.,* Cheney Bros. v. Doris Silk Corp., 35 F.2d 279, 280 (2d Cir. 1929) (dicta), *cert. denied,* 281 U.S. 728 (1930); Verney Corp. v. Rose Fabric Converters Corp., 87 F. Supp. 802, 804 (S.D.N.Y. 1949). *Cf.* Kemp & Beatley, Inc. v. Hirsch, 34 F.2d 291, 292 (E.D.N.Y. 1929) (dress pattern).

39. *See, e.g.,* Peter Pan Fabrics, Inc. v. Martin Weiner Corp., 274 F.2d 487, 489 (2d Cir. 1960); Peter Pan Fabrics, Inc. v. Candy Frocks, Inc., 187 F. Supp. 334, 335 (S.D.N.Y. 1960); Scarves by Vera, Inc. v. United Merchants & Manuf., Inc., 173 F. Supp. 625, 627 (S.D.N.Y. 1959); Peter Pan Fabrics, Inc. v. Brenda Fabrics, Inc., 169 F. Supp. 142, 143 (S.D.N.Y. 1959).

tions said as much.[40] Indeed, any two-dimensional graphic work could arguably be "identified separately" from the utilitarian article to which it was applied, and copyright registrations were issued in connection with graphic designs appearing on products ranging from shoe soles[41] to dinnerware.[42] Yet there were limits. When the graphic elements went beyond mere applique and became more intimately associated with the utilitarian features of the article, protection was denied.[43]

The test of separate identity and independent existence could be particularly troublesome when the copyright claim was directed at three-dimensional aspects of utilitarian articles. Some objects presented little difficulty. The "Flying Lady" hood ornament could be detached from the accompanying Rolls-Royce, yielding a perfectly independent statuette. With a bit more imagination, gargoyles could be mentally chiseled from pediments, and lamp shades and sockets stripped from dancing figures. The case law, however, presented greater challenges. For example, it seemed natural to extend protection to children's coin banks shaped in forms ranging from dogs[44] to humans,[45] despite the difficulty in identifying features "capable of existing independently." The "work of art" was the bank itself. If the overall shape of a cocker spaniel bank was protectible, could anything more than aesthetic prejudice exclude the overall shapes of tea kettles, home computers, or food processors? Other cases similarly undermined the administrative criterion. Copyright was upheld in a ring box with no men-

40. *See* 37 C.F.R. § 202.10(b) (Supp. 1956) (current version at 37 C.F.R. § 202.10(a) (1981)). *See also supra* note 35.

41. *See* SCOA Indus., Inc. v. Famolare, Inc., 192 U.S.P.Q. (BNA) 216 (S.D.N.Y. 1976).

42. *See* Syracuse China Corp. v. Stanley Roberts, Inc., 180 F. Supp. 527 (S.D.N.Y. 1960). Attempts to obtain copyright for two-dimensional designs on useful objects had met with some success even before *Mazer*. *See, e.g.*, Richardson v. Miller, 20 F. Cas. 722 (C.C.D. Mass. 1877) (No. 11,791) (playing cards); William A. Meier Glass Co. v. Anchor Hocking Glass Corp., 95 F. Supp. 264 (W.D. Pa. 1951) ("loop" design on glassware). *Cf.* Ex parte Guild, 98 U.S.P.Q. (BNA) 464 (Pat. Off. Bd. App. 1952) (copyright registration on roof design).

43. *See* Eltra Corp. v. Ringer, 579 F.2d 294 (4th Cir. 1978) (type-face design); Vacheron & Constantin-Le Coultre Watches Co. v. Benrus Watch Co., 155 F. Supp. 932 (S.D.N.Y. 1957) *aff'd on other grounds*, 260 F.2d 637 (2d Cir. 1958) (appearance of watch face not copyrightable under initial post-*Mazer* regulation, 37 C.F.R. § 202.10(c) (Supp. 1956)).

44. *See* Royalty Designs, Inc. v. Thrifticheck Serv. Corp., 204 F. Supp. 702 (S.D.N.Y. 1962).

45. *See* Goldman-Morgen, Inc. v. Dan Brechner & Co., 411 F. Supp. 382 (S.D.N.Y. 1976).

tion of separability,[46] and registration issued for a series of molds used in the manufacture of ceramic figures.[47] Yet such objects offered no obviously separable elements; the art lay in the articles themselves.

The gap between copyright and industrial design was further narrowed when copyright was recognized in an antique telephone shape used as the outer casing of a pencil sharpener.[48] The court, concluding that the Copyright Office regulations did not preclude protection because "the telephone casing could be separated physically from the pencil sharpener,"[49] declared the casing a "work of art" and enjoined the defendant from distributing a substantially similar product. But casings, covers, and cabinets could be removed from a host of commercial products, and the regulations offered little basis for distinctions.

Despite the shortcomings of the doctrinal formulations,[50] both the courts and the Copyright Office maintained the conviction that copyright protection for the general design of commercial products was inappropriate. Efforts to achieve a general revision of the copyright law began within a year after the decision in *Mazer v. Stein,* and throughout the twenty-one years of legislative machinations that preceded the enactment of the current statute, the Copyright Office consistently counseled against the extension of copyright to industrial design.[51]

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46. *See* Dan Kasoff, Inc. v. Gresco Jewelry Co., 204 F. Supp. 694 (S.D.N.Y. 1962), *aff'd,* 308 F.2d 806 (2d Cir. 1962).

47. *See* S-K Potteries & Mold Co. v. Sipes, 192 U.S.P.Q. (BNA) 537 (N.D. Ind. 1976) (no determination of copyright validity).

48. *See* Ted Arnold Ltd. v. Silvercraft Co., 259 F. Supp. 733 (S.D.N.Y. 1966).

49. *Id.*

50. The basic criterion applied by the Copyright Office to determine registrability as a work of art is the existence of artistic features which can be identified separately from any utilitarian article and which are capable of existing independently from the article as works of art. The difficulty of administering this criterion is one reason for the support given by the Copyright Office for specialized design legislation.

Hearings on H.R. 2223 Before the Subcomm. on Courts, Civil Liberties, and the Administration of Justice of the House Comm. on the Judiciary, 94th Cong., 1st Sess. (1975) (Copyright Office Briefing Papers on Current Issues Raised by H.R. 2223, May 7, 1975), *reprinted in* 16 OMNIBUS COPYRIGHT REVISION LEGISLATIVE HISTORY 2051, 2066 (1977).

51. In the years since the Mazer decision, full protection under the copyright law has not proved inappropriate for "works of art" used as a design or decoration of useful articles. We do not believe, however, that it would be appropriate to extend the copyright law to industrial designs as such.

HOUSE COMM. ON THE JUDICIARY, 87TH CONG., 1ST SESS., COPYRIGHT LAW REVISION, REPORT OF THE REGISTER OF COPYRIGHTS ON THE GENERAL REVISION OF THE U.S. COPYRIGHT LAW 13 (Comm. Print 1961).

II. THE COPYRIGHT ACT OF 1976

A. THE REVISION EFFORT

The decision to undertake a major revision of United States copyright law provided proponents of protection for industrial design a unique opportunity. Influenced perhaps by the position of the Copyright Office, however, their energies focused not on copyright per se, but rather on a series of companion bills offering sui generis protection for ornamental designs of useful articles.

In a 1961 report, the Copyright Office reaffirmed its opposition to the extension of copyright in useful articles beyond that available under its existing regulations.[52] Noting the anticompetitive consequences of broad protection for commercial design, the report concluded that the duration of copyright and the potential liability of innocent distributors, together with other specifics of the copyright system, made copyright protection unsuitable for industrial design.[53] Instead, the report urged consideration of separate industrial design legislation. The suggestion was hardly novel. Bills for the protection of industrial design had been introduced regularly since the turn of the century,[54] and the issue had generated a plethora of conflicting analysis. The Copyright Office itself had developed an extensive bibliography on the subject.[55]

During the 1960's, separate design protection bills passed the Senate on three occasions.[56] In 1969, the Senate formally joined the design proposals with copyright revision.[57] Carried by the momentum of the revision effort, design protection legislation appeared as Title II of the general copyright revision bill when the Senate ultimately forwarded the legislation to the House in 1976.[58] Title II provided protection for the "original ornamental design of a useful article."[59] "Staple or commonplace" designs were excluded, together with those "dictated solely by a utilization function of the article."[60] Protection ex-

52. *See id.*
53. *See id. See generally* Ringer, *The Case for Design Protection and the O'Mahoney Bill*, 7 BULL. COPYRIGHT SOC'Y 25 (1960).
54. *See supra* note 6.
55. *See* COPYRIGHT OFFICE, BIBLIOGRAPHY ON DESIGN PROTECTION (1955 & Supp. 1959). The Bibliography was further updated in 1976. *See supra* note 7.
56. H.R. REP. NO. 1476, *supra* note 3, at 50.
57. *Id.*
58. *Id.* at 49-50.
59. S. 22, tit. II, *supra* note 6, § 201(a).
60. *Id.* § 202. In an effort to win congressional approval, the three-dimen-

tended for a maximum of ten years,[61] and prohibited the manufacture, importation, or sale of articles "the design of which has been copied from the protected design, without the consent of the proprietor."[62] The bill established administrative machinery for the registration of protectible designs, but left to the President the designation of the appropriate governmental office to oversee the scheme.[63] Title I provided that copyright in works utilized in connection with useful articles was unaffected by the protection available under Title II, unless the proprietor actually obtained a Title II registration.[64]

Title II, designated the Design Protection Act of 1975,[65] did not survive consideration in the House. The Judiciary Committee "chose to delete Title II in part because the new form of design protection provided by Title II could not truly be considered copyright protection and therefore appropriately within the scope of copyright revision."[66] The House Report made passing reference to the bill's failure to designate a specific agency to administer the system, although the Copyright Office had by this time volunteered its services,[67] and to the unresolved issue of protection for typeface designs.[68] The principal objection, however, was more fundamental:

> Finally, the Committee will have to examine further the assertion of the Department of Justice, which testified in opposition to the Title, that Title II would create a new monopoly which has not been justified by a showing that its benefits will outweigh the disadvantage of removing such designs from free public use.[69]

Proponents of specialized design protection were left only with

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sional shape of wearing apparel was also excluded. *Id.* § 202(3). *See* SECOND SUPPLEMENTARY REPORT, *supra* note 30, at 204.

61. S. 22, tit. II, *supra* note 6, § 205.

62. *Id.* § 208. "Innocent" retailers were afforded a broad measure of protection. *Id.* § 208(a)(2).

63. *Id.* § 230.

64. S. 22, tit. I, 94th Cong., 1st Sess. § 113(c), 122 CONG. REC. 3841, 3845 (1975), *reprinted in* S. REP. NO. 473, 94th Cong., 1st Sess. 12 (1975). Passage of Title II would thus not have eliminated the need to confront the issue of copyright in useful articles.

65. S. 22, tit. II, *supra* note 6, § 235.

66. H.R. REP. NO. 1476, *supra* note 3, at 50.

67. S. REP. NO. 473, 94th Cong., 1st Sess. 166 (1975); SECOND SUPPLEMENTARY REPORT, *supra* note 30, at 205-06.

68. H.R. REP. NO. 1476, *supra* note 3, at 50. The question of copyright or other protection for typeface designs had stirred considerable controversy during the latter stages of the revision effort. Of particular concern was the possibility of "creating exclusive rights for a few big manufacturers, who would use them to enforce tying arrangements between their machines and fonts," and the specter of "suits to enjoin publication of printed matter" composed from infringing type. SECOND SUPPLEMENTARY REPORT, *supra* note 30, at 201.

69. H.R. REP. NO. 1476, *supra* note 3, at 50. The Conference Committee ac-

an invitation to try again.[70]

The legislative energy necessary to grapple with the issue of design protection was apparently exhausted in the formulation of Title II. In the copyright revision bill itself, there was old wine in old bottles. The cornerstone of the revision bill's approach to copyright in useful articles was a narrow codification of *Mazer*,[71] which Congress read as holding "that works of art which are incorporated into the design of useful articles, but which are capable of standing by themselves as art works separate from the useful article, are copyrightable."[72] The "works of art" classification of the 1909 Act was abandoned and replaced by a reference to "pictorial, graphic, and sculptural works."[73] This new category endeavored to supply "as clear a line as possible between copyrightable works of applied art and uncopyrighted works of industrial design."[74] The line, however, was neither clear nor new. After declaring that "pictorial, graphic, and sculptural works" included works of "applied art," the definition stated:

> [T]he design of a useful article, as defined in this section, shall be considered a pictorial, graphic, or sculptural work only if, and only to the extent that, such design incorporates pictorial, graphic, or sculptural features that can be identified separately from, and are capable of existing independently of, the utilitarian aspects of the article.[75]

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ceded to the House position. *See* H.R. REP. No. 1733, 94th Cong., 2d Sess. 82 (1976).

70. The issues raised by Title II have not been resolved by its deletion from the Copyright Revision Bill. Therefore, the Committee believes that it will be necessary to reconsider the question of design protection in new legislation during the 95th Congress. At that time more complete hearings on the subject may be held and, without the encumbrance of a general copyright revision bill, the issues raised in Title II of S. 22 may be resolved.

H.R. REP. No. 1476, *supra* note 3, at 50. "The full range of design protection issues, however, stands as one of the most significant and pressing items of unfinished business now on the Congressional agenda." Ringer, *The Unfinished Business of Copyright Revision*, 24 U.C.L.A. L. REV. 951, 976 (1977). For the latest effort, see H.R. 20, 97th Cong., 1st Sess. (1981), *reprinted in* 2 COPYRIGHT L. REP. (CCH) ¶ 20,097 (1981).

71. "Subject to the provisions of subsections (b) and (c) of this section, the exclusive right to reproduce a copyrighted pictorial, graphic, or sculptural work in copies under section 106 includes the right to reproduce the work in or on any kind of article, whether useful or otherwise." 17 U.S.C. § 113(a) (1976). *See also* 17 U.S.C. § 101 (1976) (definition of "pictorial, graphic, and sculptural works").

72. H.R. REP. No. 1476, *supra* note 3, at 50.

73. 17 U.S.C. § 102(a)(5) (1976).

74. H.R. REP. No. 1476, *supra* note 3, at 55. The Report refers to the effort to achieve clear lines and distinctions twice in the space of three paragraphs, apparently seeking credit at least for good intentions.

75. 17 U.S.C. § 101 (1976). In its entirety, the definition states:

The administrative regulations of the 1950's were now formally codified in the Copyright Act of 1976.[76]

The legislative history sheds additional light on the familiar criteria of separate identity and independent existence. Two-dimensional graphic works and three-dimensional carvings or statues incorporated into utilitarian articles can exist independently as works of art and are thus eligible for copyright.[77] Congress was unmistakably clear, however, that it intended to exclude industrial design from the subject matter of copyright:

> 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. Unless the shape of an automobile, airplane, ladies' dress, food processor, television set, or any other industrial product contains some element that, physically or conceptually, can be identified as separable from the utilitarian aspects of that article, the design would not be copyrighted under the bill.[78]

The reference to "physically or *conceptually*"[79] separable elements perhaps extended prior law, but little else was new. "Applied art" was in and "industrial design" was out. Yet at some point the two met, and "separability" had already proven a poor benchmark.

The failure to win protection for industrial design reflects more than the vagaries of the legislative process. Sixty years of unsuccessful lobbying suggests more substantive difficulties.

> "Pictorial, graphic, and sculptural works" include two-dimensional and three-dimensional works of fine, graphic, and applied art, photographs, prints and art reproductions, maps, globes, charts, technical drawings, diagrams, and models. Such works shall include works of artistic craftsmanship insofar as their form but not their mechanical or utilitarian aspects are concerned; the design of a useful article, as defined in this section, shall be considered a pictorial, graphic, or sculptural work only if, and only to the extent that, such design incorporates pictorial, graphic, or sculptural features that can be identified separately from, and are capable of existing independently of, the utilitarian aspects of the article.

Id. A definition of "useful article" is also provided: "A 'useful article' is an article having an intrinsic utilitarian function that is not merely to portray the appearance of the article or to convey information. An article that is normally a part of a useful article is considered a 'useful article.'" *Id.*

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

77. H.R. REP. NO. 1476, *supra* note 3, at 55.

78. *Id.*

79. *Id.* (emphasis added). The Copyright Office had previously employed the phrase "conceptually separated" in an effort to describe the import of its existing regulation on separability. *See* SECOND SUPPLEMENTARY REPORT, *supra* note 30, at 194. *But see* Esquire, Inc. v. Ringer, 591 F.2d 796, 803-04 (D.C. Cir. 1978), *cert. denied*, 440 U.S. 908 (1979) (dismissing the House Report's "isolated reference" to conceptual separability).

One can appreciate the reluctance of Congress to subsume industrial design within the scope of copyright, or to authorize a more specialized monopoly, by considering the basic arguments generally used to support the recognition of proprietary rights in intellectual property.

The Constitution, authorizing legislation "To promote the Progress of Science and useful Arts,"[80] suggests an incentive rationale designed to encourage artistic and inventive activity through the prospect of exclusive rights in the tangible results of creative efforts.[81] Such stimuli may be necessary, it is argued, when the ease of copying impedes the producer's ability to extract through the market the reward that consumers would otherwise willingly pay. Without protection against copying, there may be less investment of resources in creative activity than society would wish. Such proprietary rights must be limited, of course, or the public will be effectively denied the benefits sought by the constitutional mandate. At this level, the copyright and patent laws reflect a balance between incentive and dissemination through competition.

This economic perspective is sometimes supplemented by moral appeals. The idea of a natural right to the fruits of one's labors, and the aversion to permitting the enrichment of another at the producer's expense, are no less powerful here than in other areas of the law.[82] In the realm of artistic works, there is the further notion that the intimate relationship between art and artist justifies special efforts to preserve the integrity of the work.[83] From both economic and moral vantage points, however, the case for expansive design protection is weak.

The most obvious effect of extending copyright or more specialized protection to the design of commercial products would be the exclusion of such designs from the public domain, thus preventing their free use by competing manufacturers.[84] The necessity of such an artificial incentive, however, is hardly

80. U.S. CONST. art. I, § 8, cl. 8.

81. "The 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.'" Mazer v. Stein, 347 U.S. 201, 219 (1954).

82. *See* Denicola, *supra* note 30, at 519-20.

83. *See* 2 M. NIMMER, NIMMER ON COPYRIGHT § 8.21 (1982).

84. At present, only those designs capable of meeting the stringent requirements of design patent law may remain outside the public domain. *See supra* note 30.

clear.[85] In one sense, manufacturers do not have the option of discontinuing the creation of industrial designs, since all products must take on *some* shape and appearance. Thus the question is not whether manufacturers will design, but rather how large an investment of resources they will devote to the development of designs possessing some particular virtue or appeal. Even without the stimulus provided by the prospect of a statutory monopoly, there appear to be significant incentives to invest in design. If that is indeed the case, restraints on competition may achieve little in the way of increased design activity.

The most obvious incentive to produce appealing designs is the desire to attract customers, since "[b]etween two products equal in price, function, and quality, the better looking will outsell the other."[86] Even a design that is merely different rather than "better" may have its advantages, because it may appeal to a desire for diversity or distinctiveness and aid in marketing by differentiating the product from its rivals. By accentuating performance characteristics such as strength, durability, or workmanship, an appropriate design may increase sales even when aesthetic appeal is not a significant consideration. Effort invested in design may also result in enhanced performance or reduced production costs.[87]

Given the obvious advantage of a well conceived product design, the question becomes whether the risk of appropriation by a competitor will nevertheless cause manufacturers to significantly decrease their investment of resources in design activity. For several reasons, the answer may often be "No." The cost of creating an appealing design, for example, may represent only a small fraction of total product development and production costs. With so much at stake, a manufacturer is unlikely to forego the substantial benefits of a well designed product merely because a competitor might gain a marginal

85. This was the chief justification for the opposition of the Department of Justice to Title II of the revision bill. *Hearings on H.R. 2223 Before the Subcomm. on Courts, Civil Liberties, and the Administration of Justice of the House Comm. on the Judiciary*, 94th Cong., 1st Sess. (1975) (testimony of Irwin Goldbloom), *reprinted in* 14 OMNIBUS COPYRIGHT REVISION LEGISLATIVE HISTORY 139-40 (1977).

86. R. LOEWY, INDUSTRIAL DESIGN 10 (1979).

87. If the cost of manufacturing a more attractive product is high enough to price the resulting article above the range consumers are willing to pay, however, even a statutory monopoly will not prompt production, if indeed production is desirable. The prospect of a monopoly in a product that cannot be sold at a profit is hardly enticing.

saving through design piracy. If the design is indeed advantageous, even a relatively short lead time may be sufficient to permit recovery of design costs. In addition, the risk of copying may frequently be overstated. Outside the limited reach of design patent law, no legal barrier currently exists to prevent design piracy. Yet variations in product appearance continue to be the norm. Indeed, there are *disincentives* to copying. Product differentiation may be as valuable to a competitor as to the design originator. Major competitors may be reluctant to tarnish their image by engaging in design piracy, since consumers frequently associate copies with lower quality and desirability. Copying may sometimes cause consumers to confuse the copy with the original, thus creating potential liability in an action for trademark infringement or unfair competition.[88] Even when

88. In an effort to forestall confusion and deceit, the common law of unfair competition has long prohibited the copying of nonfunctional product and container shapes that the public has come to associate with a particular manufacturer. *See* 1 J. McCarthy, Trademarks and Unfair Competition § 7:23 (1973). This common law protection, however, was called into question by the Supreme Court's decisions in Sears, Roebuck & Co. v. Stiffel Co., 376 U.S. 225 (1964), and Compco Corp. v. Day-Brite Lighting, Inc., 376 U.S. 234 (1964). Both decisions indicated that state law could not prohibit the copying of articles left unprotected by federal patent and copyright law, regardless of the potential for consumer confusion. *Sears* and *Compco*, however, had little effect on the protection of product shapes under *federal* trademark law. The Patent and Trademark Office has continued to extend protection to shapes and configurations that function as an indication of source. *See, e.g., In re* Mogen David Wine Corp., 372 F.2d 539 (C.C.P.A. 1967) (protection denied for lack of source significance); *In re* Days-Ease Home Product Corp., 197 U.S.P.Q. (BNA) 566 (T.M. Trial App. Bd. 1977) (registration granted for shape of liquid drain opener container). Even shapes and designs that have not been federally registered as trademarks have been able to escape the thrust of *Sears* and *Compco* through the invocation of section 43(a) of the Lanham Act, 15 U.S.C. § 1125(a) (1976), which prohibits any "false designation of origin, or any false description or representation." *See, e.g.*, SK&F, Co. v. Premo Pharmaceutical Laboratories, Inc., 625 F.2d 1055, 1065-66 (3d Cir. 1980); Ives Laboratories, Inc. v. Darby Drug Co., 601 F.2d 631, 641-44 (2d Cir. 1979) (dicta), *on remand*, 488 F. Supp. 394 (E.D.N.Y. 1980), *rev'd on other grounds*, 638 F.2d 538 (2d Cir. 1981), *rev'd on other grounds*, 102 S. Ct. 2182, 2193 (1982) (White and Marshall, JJ., concurring) ("The use of a product or package design that is so similar to that of another producer that it is likely to confuse purchasers as to the product's source may constitute 'false designation of origin'. . . ."); Truck Equip. Serv. Co. v. Fruehauf Corp., 536 F.2d 1210, 1215-16 (8th Cir. 1976), *cert. denied*, 429 U.S. 861 (1976). With surprising pluck, several courts have simply rejected the rationale of *Sears* and *Compco* and continued to offer protection under *state* unfair competition law. *See, e.g.*, SK&F, Co. v. Premo Pharmaceutical Laboratories, Inc., 625 F.2d 1055, 1064-65 (3d Cir. 1980); Time Mechanisms, Inc. v. Qonaar Corp., 422 F. Supp. 905, 908-10 (D.N.J. 1976); Duo-Tint Bulb & Battery Co. v. Moline Supply Co., 46 Ill. App. 3d 145, 150-51, 360 N.E.2d 798, 802 (1977) (dicta).

The Supreme Court retreated from its unbending approach to preemption in Goldstein v. California, 412 U.S. 546 (1973), holding that the patent and copyright clause did not preclude state protection of "writings," and that the 1909 copying does occur, its impact may be modest if the utilitarian

Copyright Act did not preempt protection of works that it had left "unattended," since for such works Congress had "drawn no balance." *Id.* at 570. The Court again considered the relationship between federal and state protection for intellectual property in Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470 (1974). After declaring that the constitutional clause did not withdraw from the states all power to regulate with respect to "discoveries," thus completing the analysis of the clause begun by *Goldstein*, the Court concluded that state protection of intellectual property was not void under the supremacy clause even when extended to areas covered by federal legislation, unless the state scheme clashed with federal objectives. *Id.* at 478-79.

In the context of federal trademark registration, the Court of Customs and Patent Appeals has on numerous occasions taken pains to point out that trademark protection does not conflict with the objectives of design patent law. *See, e.g., In re* Honeywell, Inc., 497 F.2d 1344, 1348 (C.C.P.A.), *cert. denied*, 419 U.S. 1080 (1974); *In re* World's Finest Chocolate, Inc., 474 F.2d 1012, 1015 (C.C.P.A. 1973); *In re* Mogen David Wine Corp., 328 F.2d 925, 928-30 (C.C.P.A. 1964). Consequently, there appears to be little danger that even state trademark protection for nonfunctional product shapes is preempted by federal design patent law. *See* Rolls-Royce Motors Ltd. v. A & A Fiberglass, Inc., 428 F. Supp. 689, 689-99 (N.D. Ga. 1976).

The preemptive force of federal copyright law is now delimited by section 301 of the Copyright Act of 1976, 17 U.S.C. § 301 (1976). State protection of works within the subject matter of copyright is preempted if the rights afforded are equivalent to copyright. One might argue that since the design aspects of useful articles are copyrightable only if separable from the utilitarian aspects of the object, nonseparable designs are thus not within the subject matter of copyright. *See* Vermont Castings, Inc. v. Evans Prods. Co., 215 U.S.P.Q. (BNA) 758 (D. Vt. 1981). *See also* Leonard Storch Enterprises, Inc. v. Mergenthaler Linotype Co., 202 U.S.P.Q. (BNA) 623 (E.D.N.Y. 1979) (1909 Act). *Cf.* Goldstein, *Preempted State Doctrines, Involuntary Transfers and Compulsory Licenses: Testing the Limits of Copyright*, 24 U.C.L.A. L. Rev. 1107, 1118-20 (1977) (making an analogous argument with respect to ideas, procedures, and other contributions expressly excluded from copyright by 17 U.S.C. § 102(b) (1976)). Such an approach, however, ignores the basic premise of the subject matter test. Essentially a codification of *Goldstein*, the test is apparently intended to permit state regulation of areas left "unattended" by copyright law. Yet Congress has in fact drawn a balance with respect to industrial designs, excluding all nonseparable elements from protection. The viability of state laws touching industrial design should therefore turn on whether the state rights are "equivalent" to copyright.

Since relief under principles of state trademark or unfair competition law generally requires a showing of consumer confusion or deception, these state regimes have not been considered "equivalent" to copyright protection for purposes of section 301. *See, e.g.,* DC Comics, Inc. v. Filmation Associates, 486 F. Supp. 1273, 1278 (S.D.N.Y. 1980); John H. Harland Co. v. Clarke Checks, Inc., 207 U.S.P.Q. (BNA) 664, 668 (N.D. Ga. 1980). Thus the traditional common law protection extended to nonfunctional product shapes and features that have acquired source significance is not preempted by current copyright law. Occasionally, however, despite the consumer confusion rhetoric, protection appears to rest primarily on a notion of misappropriation through unauthorized copying. *See, e.g.,* Rolls-Royce Motors Ltd. v. A & A Fiberglass, Inc., 428 F. Supp. 689, 694 (N.D. Ga. 1976); Denicola, *Trademarks as Speech: Constitutional Implications of the Emerging Rationales for the Protection of Trade Symbols*, 1982 Wis. L. Rev. 158, 166-81. When the misappropriation rationale is surreptitiously implemented by means of federal law, such as sections 32 or 43(a) of the Lanham Act, 15 U.S.C. §§ 1114, 1125(a) (1976), *see, e.g.,* Boston Professional qualities of the original cannot be duplicated because of mechanical patent or trade secret protection, or because of the copier's less sophisticated production capabilities.

The moral claims to industrial design protection are also significantly weaker than those that might be made with respect to other artistic works. The threat of unjust enrichment is less worrisome than in other contexts, since we associate industrial design with the well-lighted drafting rooms of large commercial entities, and thus there are no images of starving novelists or destitute painters to tug at our heartstrings. For similar reasons, we are less concerned with artistic reputation or integrity. On a less emotional level, the arguments offered suggest that both the risk of appropriation and the extent of the potential harm are generally less for the industrial designer than for the novelist, movie producer, or songwriter. Finally, the exclusion of industrial design from the scope of copyright need not be taken as an indictment of its validity or importance. The law of intellectual property covers but a small portion of the full range of creative activity,[89] and there is no dishonor in joining the theories of Einstein or the insights of Freud in the public domain.

Copyright protection for industrial design would also present severe practical difficulties. The idea-expression dichotomy and the "substantial similarity" test of copyright infringement may be too ephemeral to adequately protect legitimate competitive interests, particularly when commercial realities limit the

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Hockey Assoc. v. Dallas Cap & Emblem Mfg., 510 F.2d 1004, 1010 (5th Cir.), *cert. denied*, 423 U.S. 868 (1975), the preemption issue is avoided. 17 U.S.C. § 301(d) (1976). When the common law is relied on to forestall the misappropriation of another's design efforts, however, the state right may indeed be equivalent to copyright, thus raising the bar of section 301. *See, e.g.*, Durham Indus., Inc. v. Tomy Corp., 630 F.2d 905, 918-19 (2d Cir. 1980). *Cf.* Suid v. Newsweek Magazine, 503 F. Supp. 146, 149 (D.D.C. 1980) (unfair competition claim based on unauthorized use of literary material preempted); Mitchell v. Penton/Indus. Pub. Co., 486 F. Supp. 22, 25-26 (N.D. Ohio 1979) (same). *See generally* 1 M. NIMMER, *supra* note 83, § 1.01[B].

89. [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 communication to others, free as the air to common use.

International News Serv. v. Associated Press Inc., 248 U.S. 215, 250 (1918) (Brandeis, J., dissenting). *See, e.g.*, 17 U.S.C. § 102(b) (1976) ("In no case does copyright protection for an original work of authorship extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied in such work.").

range of design alternatives.[90] In addition, the specter of infringement may actually inhibit experimentation with new designs, or require additional expenditures to assess potential legal risks.

The arguments for and against design protection are longstanding.[91] They inevitably rest on a host of assumptions that cannot possibly hold across the wide range of goods and markets encompassed by the controversy. The fact remains, however, that Congress has emphatically declined to extend copyright protection to industrial design, and the Copyright Act of 1976 must be construed in light of that fundamental decision. Yet, care must be taken to avoid indiscriminate application of the statutory exclusion to works whose origins lie beyond the confines of the design process.

B. Conventional Models

The Copyright Office regulation that introduced the separability test, following the Supreme Court decision in *Mazer v. Stein*, excluded from the "works of art" classification any article whose "sole intrinsic function . . . is its utility."[92] That formulation, however, had the disquieting potential to defeat all efforts to bar industrial design from the scope of copyright. Given judicial reluctance to assess artistic merit, there was no ready response to the claims of industrial designers that their work was not solely utilitarian, since it was also offered as art. An object serving aesthetic as well as utilitarian ends appeared beyond the reach of the regulatory limitation. Obviously, the administrative intent was not to abandon the grist for its mill, but the difficulty did underscore the primitive nature of the doctrinal machinery.

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90. *See, e.g.*, Note, *supra* note 6, at 1524-27; Comment, *Copyright Protection for Mass-Produced, Commercial Products: A Review of the Developments Following* Mazer v. Stein, 38 U. CHI. L. REV. 807, 809-14 (1971).

91. The dispute is not unique to American law. *See, e.g.*, Cornish, *Cumulative Protection for Industrial Designs*, 8 U. BRIT. COLUMBIA L. REV. 219 (1973); Crew, *Undesirable in Theory, Absurd in Practice—the Protection of Industrial Designs in England and New Zealand*, 2 AUCKLAND U.L. REV. No. 4, 1 (1975); Moon, *Copyright in Artistic Works: The Extension to Mechanical Design*, 1979 N. ZEALAND L.J. 282 (1979); Moon, *A Functional View of Copyright, Designs and Patents*, 8 VICTORIA U.L. REV. 300 (1976); Wallace, *Protection for Designs in the United Kingdom*, 22 BULL. COPYRIGHT SOC'Y 437 (1975). For the most recent British proposals, see UNITED KINGDOM GREEN PAPER: REFORM OF THE LAW RELATING TO COPYRIGHT, DESIGNS AND PERFORMERS' PROTECTION, *reprinted in* 28 BULL. COPYRIGHT SOC'Y 569, 573-77 (1981).

92. 37 C.F.R. § 202.10(c) (1959) (revoked Jan. 1, 1978, 43 Fed. Reg. 966 (1978)).

The concept of a useful article, as embodied in the "sole intrinsic function" standard, played a role in an important 1966 decision that provided designers a welcome precedent. In *Ted Arnold Ltd. v. Silvercraft Co.*,[93] the court recognized copyright in the casing of a pencil sharpener simulating the appearance of an antique telephone: "[W]e would not agree with defendant that its 'sole intrinsic function . . . is its utility.' Customers are paying fifteen dollars for it, not because it sharpens pencils uncommonly well, but because it is also a decorative conversation piece."[94]

As the revision effort was nearing its conclusion, another case tested the bounds of the useful article classification. *Esquire, Inc. v. Ringer*[95] was a mandamus action to compel the Register of Copyrights to issue a registration for the design of an outdoor lighting fixture "of pleasing shape . . . well suited to accompany structures of so-called functional design."[96] The Copyright Office denied registration on the ground that the work lacked features that could be identified separately as art. Esquire argued that its fixtures were modern sculptures, and thus their "sole intrinsic function" was not utility. The district court apparently agreed: "These outdoor lights serve both to decorate and to illuminate. Indeed, during the day they are exclusively decorative."[97] On appeal, however, Esquire's summary judgment was reversed. In a novel interpretive maneuver, the court alluded to the deletion of the word "sole" in the revision bill's definition of "useful article," and proceeded to construe the existing regulation in light of the as yet inoperative statutory formulation.[98]

The separability test contained in the 1976 Act's definition of "pictorial, graphic, and sculptural works" is by its terms applicable to copyright in the design of a "useful article."[99] The latter is described in section 101 as "an article having an intrinsic function that is not merely to portray the appearance of the article or to convey information."[100] The substitution of "an intrinsic function" for "sole intrinsic function" avoids the embar-

93. 259 F. Supp. 733 (S.D.N.Y. 1966).

94. *Id.* at 736 (footnote omitted).

95. 591 F.2d 796 (D.C. Cir. 1978), *cert. denied*, 440 U.S. 908 (1979).

96. 414 F. Supp. 939, 940 (D.D.C. 1976).

97. *Id.* at 941.

98. 591 F.2d at 804.

99. 17 U.S.C. § 101 (1976) (definition of "pictorial, graphic, and sculptural works").

100. *Id.* (definition of "useful article").

rassment caused by the prior formulation,[101] but only at the expense of introducing new discomfort. If the Copyright Office regulation arguably left nothing subject to the separability test, the statutory definition may render it applicable to virtually all three-dimensional works. Almost any sculptural work can be put to functional uses ranging from bookends or doorstops to paperweights or architectural elements. Unless the Delphic reference to "intrinsic function" is shamelessly exploited, few objects will escape this new formulation. Indeed, one court has already held that a toy plane is a "useful article" under the 1976 Act, since children can use the plane to develop their imagination.[102]

These definitional difficulties illustrate two points about copyright in utilitarian objects. The most obvious is that useful articles do not comprise a distinct class easily isolated from other forms of authorship. Definitions can do little more than focus attention on one portion of a spectrum ranging from bicycles to busts of Beethoven. As a result, the issue of copyright in utilitarian articles cannot be evaded by semantic stratagems and even eventual passage of sui generis design legislation or the overhaul of the existing design patent regime cannot eliminate the copyright implications of aesthetically pleasing useful objects.[103] The definitional debate also has less obvious implications. Despite the knowledge that a bust of Beethoven may be useful in holding down papers or holding up books, an analogy to the design of baby carriages or food processors strikes us as silly. We feel confident that the specialized legislative machinery is inappropriate for such a work, regardless of the difficulties inherent in formulating a less inclusive definition. Even if the statutory description of useful articles should happen to encompass all three, we would expect the bust to survive the subsequent analysis with full copyright protection intact. Our instincts suggest a helpful insight. We may feel comfortable extending protection to the appearance of the bust

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101. *See supra* text accompanying note 92.

102. Gay Toys, Inc. v. Buddy L. Corp., 522 F. Supp. 622, 625 (E.D. Mich. 1981). *But see* Monogram Models, Inc. v. Industro Motive Corp., 492 F.2d 1281, 1284 (6th Cir.), *cert. denied*, 419 U.S. 843 (1974) (copyright upheld in model airplane kit). The only alternative to either an overly inclusive or overly exclusive definition would appear to be an inquiry into an object's "primary function"—hardly an approach calculated to increase certainty and predictability.

103. Recent design protection bills make no attempt to preempt copyright protection for utilitarian objects. *See, e.g.*, S. 22, tit. II, *supra* note 6, § 227; H.R. 20, 97th Cong., 1st Sess. § 927 (1981), *reprinted in* 2 COPYRIGHT L. REP. (CCH) ¶ 20,097 (1981).

despite its possible usefulness in part because its form is independent of its utility. The bust is thus distinguishable, quantitatively if not qualitatively, from carriages or kitchen appliances whose forms are more intimately responsive to function. As Part III of this Article suggests, this notion of the relative independence of form and function may provide a rational perspective on the otherwise largely irrational dictates of the separability test. The 1976 Act obliges both the Copyright Office and the courts to continue their efforts to distinguish applied art and industrial design. The only assistance the Act offers, however, is the statement that the design of a useful article is protectible only to the extent that it "incorporates pictorial, graphic, or sculptural features that can be identified separately from, and are capable of existing independently of, the utilitarian aspects of the article."[104]

Because *Mazer* provided the focal point for the congressional analysis, it is tempting to approach the separability test in essentially physical terms. In *Mazer*, the dancing figures at issue could be physically separated from the utilitarian objects into which they had been incorporated by the twist of a socket and a sharp tug on an electric cord. Reliance on this simplistic notion of physical separation, however, is misplaced. The legislative history unequivocally indicates that pictorial works adorning useful articles are entitled to copyright, yet the pattern dyed into a bolt of cloth or painted on a china cup cannot be physically detached from the object itself. In addition, some features of utilitarian objects that *can* be physically separated are clearly *not* intended to fall within the scope of copyright. An ordinary television cabinet may be physically removed from the set itself, yet protection will not be forthcoming. Physical separability is a poor touchstone, inaccurate as a descriptive concept,[105] and devoid of normative implications. The legislative history acknowledges the necessity of a more esoteric approach, referring at one point to "some element that, physically *or conceptually*, can be identified as separable."[106] The notion of conceptual separability, however, can be little more than an invitation to thoughtful analysis. It has meaning only in the

104. 17 U.S.C. § 101 (1976) (definition of "pictorial, graphic, and sculptural works").

105. Professor Nimmer argues that even the dancing figures in *Mazer* could not pass muster under a test of strict physical separability from the utilitarian aspects of the article since the statuettes, by virtue of their use as lamp bases, *are* a utilitarian feature of the object. 1 M. NIMMER, *supra* note 83, § 2.08[B][3].

106. H.R. REP. NO. 1476, *supra* note 3, at 55 (emphasis added).

context of a specific normative theory or model. Although there has been no shortage of such models, each with its own advantages, none appears able to discharge satisfactorily the legislative mandate.

One possible approach to the separability criterion is to interpret it as an inquiry into one's willingness to recognize the design as art, in spite of its utilitarian properties. This approach was urged by the lighting manufacturer in *Esquire*.[107] The effect of this approach, however, is to bring the analysis full circle to the 1909 Act's "works of art" classification.[108] If any design that might be labelled "art" is automatically treated as conceptually separable from the utilitarian aspects of the object, one is left with a dilemma. If judges continue to shun evaluations of merit or worth, the test will cease to be a meaningful barrier to copyright in industrial design, a result clearly in conflict with the legislative intent. If judges instead accede to the role of art critics, discrimination against nonrepresentational art will become inevitable. While judges may likely recognize as art a lamp base in the form of a human figure, they are less likely to accord similar recognition to an abstract shape, equally unresponsive to function, particularly if it "looks like" a lamp base. This is precisely the danger foreseen by Justice Holmes,[109] and echoed in *Mazer*[110] and the district court decision in *Esquire*.[111] Perhaps, as the appellate court in *Esquire* rationalized, there is less need for concern when the disparate treatment results from the application of a standard that is not itself dependent on artistic judgments,[112] but that observation offers no comfort here. Decisions on copyrightability would rest entirely on judicial perceptions of artistic value, an approach at odds with the legislative directive that the category of " 'pictorial, graphic, and sculptural works' carries with it no implied criterion of artistic taste, aesthetic value, or intrinsic

107. "Esquire on the other hand, interprets § 202.10(c) to allow copyright registration for the overall shape or design of utilitarian articles as long as the shape or design satisfies the requirements appurtenant to works of art—originality and creativity." 591 F.2d at 800 (footnote omitted).

108. Indeed, this was essentially the position initially adopted by the Copyright Office in response to the *Mazer* decision. Before being replaced by the separability standard, copyright in the shape of a useful article was permitted only "where the object is clearly a work of art in itself." 37 C.F.R. § 202.10(c) (Supp. 1956).

109. *See supra* note 10.

110. *See supra* note 10.

111. 414 F. Supp. at 941.

112. 591 F.2d at 805. The standard utilized to settle Esquire's claim barred copyright for the "overall design or configuration" of all utilitarian objects. *Id.*

quality."[113] The approach urged by the manufacturer in *Esquire*, which would extend copyright to any design deserving of the appellation "art," simply cannot implement the legislative distinction between applied art and industrial design embodied in the separability test.[114]

The vision of administrators or judges assessing the aesthetic merits of coffee pots and home computers has prompted numerous alternative models of the separability criterion. An aura of objectivity can be regained by transforming the judicial role from critic to pollster, and various formulations thus have emphasized consumer judgments. In its most expansive form, this approach may simply focus on consumer evaluations of aesthetic appeal, measured perhaps by success in the marketplace.[115] This approach, of course, merely taps an alternative source of critical evaluation without overcoming the inherent objections to conditioning legal protection on aesthetic appeal or interest. One would hardly expect the legal status of *Star Wars* or *Macbeth* to be determined by their showing at the box office.

A slightly more refined approach might attempt to dispense with the necessity of individual aesthetic appraisals by establishing general categories of commercial products for which aesthetic appeal carries particular significance.[116] Protection

113. H.R. REP. No. 1476, *supra* note 3, at 54.

114. The position of the Register of Copyrights and the District of Columbia Circuit Court, excluding the overall shape of all utilitarian objects, however, is equally unavailing. *See infra* notes 128-48 and accompanying text.

115. "We see in appellant's belt buckles conceptually separable sculptural elements, as apparently have the buckles' wearers who have used them as ornamentation for parts of the body other than the waist." Kieselstein-Cord v. Accessories by Pearl, Inc., 632 F.2d 989, 993 (2d Cir. 1980). "Customers are paying fifteen dollars for it, not because it sharpens pencils uncommonly well, but because it is also a decorative conversation piece." Ted Arnold Ltd. v. Silvercraft Co., 259 F. Supp. 733, 736 (S.D.N.Y. 1966) (copyright upheld in pencil sharpener simulating antique telephone). Appeals to consumer evaluations of commercial designs are not unique to this country. "A work of craftsmanship suggests to me a durable, useful, handmade object and a work of artistic craftsmanship suggests something, whether of practical utility or not, which its owner values because of its artistic character." George Hensher Ltd. v. Restawhile Upholstery Ltd., [1974] 2 All E.R. 420, 423.

116. *See, e.g.*, Kieselstein-Cord v. Accessories by Pearl, Inc., 632 F.2d 989, 993 (2d Cir. 1980) ("Pieces of applied art, these buckles may be considered jewelry, the form of which is subject to copyright protection . . . ."); Esquire, Inc. v. Ringer, 414 F. Supp. 939, 941 (D.D.C. 1976), *rev'd*, 591 F.2d 796 (D.C. Cir. 1978), *cert. denied*, 440 U.S. 908 (1979) ("The instant case concerns lighting in combination with sculpture. Here past interpretations of the existing regulations which have allowed registration for household lamps and candlesticks give content to the copyright regulations . . . ."); 37 C.F.R. § 202.10(a) (1977) (revoked Jan. 1, 1978, 43 Fed. Reg. 966 (1978)) ("works of artistic craftsmanship . . . such

could then be extended in a nondiscriminatory manner to all designs in selected markets. This approach, however, is only marginally less troublesome than direct appeal to consumer taste. Because the marketability of almost any product is dependent to some degree on its physical attractiveness, classification would be hopelessly arbitrary.[117] Even if limited to products traditionally reflecting a special concern for aesthetics, this model would sweep far wider than the legislative intent. Purchases of automobiles, kitchen appliances, and furniture, for example, often rest on little more than an appealing appearance, yet their designs do not generally meet the legislative vision of separability.[118]

A narrower form of this market perspective was suggested by *Kieselstein-Cord v. Accessories by Pearl, Inc.*[119] In that case the plaintiff successfully obtained copyright registrations for the design of two elaborately sculptured belt buckles. In an action for copyright infringement, however, the district court granted summary judgment for the defendant, holding that the buckles could not satisfy the separability standard.[120] The Second Circuit disagreed:

> We see in appellant's belt buckles conceptually separable sculptural elements, as apparently have the buckles' wearers who have used them as ornamentation for parts of the body other than the waist. The primary ornamental aspect of the Vaquero and Winchester buckles is conceptually separable from their subsidiary utilitarian function.[121]

Kieselstein-Cord appears to offer the prospect of protection whenever the ornamental aspects of the design are of "pri-

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as artistic jewelry, enamels, glassware, and tapestries"). *See also* Note, *supra* note 6, at 1525-26; Comment, *Copyright Law—Copyright Protection for Industrial Designs Under the 1976 Copyrights Act:* Esquire v. Ringer, *591 F.2d 796 (D.C. Cir. 1978),* cert. denied, *440 U.S. 908 (1979),* 25 WAYNE L. REV. 923, 930-31 (1979).

117. *See, e.g.,* R. LOEWY, *supra* note 86, at 119 (sales increase attributed to more attractive design for car battery).

118. H.R. REP. NO. 1476, *supra* note 3, at 55.

119. 632 F.2d 989 (2d Cir. 1980). Photographs of the articles are reproduced in 632 F.2d at 995, a helpful practice all too uncommon in the case reports. Reading both the trial and appellate opinions in *Esquire,* for example, is not unlike attempting to comprehend a book on modern architecture, painting, or sculpture without examining the illustrations.

120. 489 F. Supp. 732, 736 (S.D.N.Y.), *rev'd,* 632 F.2d 989 (2d Cir. 1980). The court held that the copyrightability of one of the buckles was determined by the 1909 Act and accompanying regulations, while the 1976 Act was applicable to the second of plaintiff's two designs, although it found the test for copyrightability "to be virtually the same." 489 F. Supp. at 735. As Professor Nimmer notes, however, although the court's decision to apply the 1909 Act to the first buckle was correct, its justification was not. 1 M. NIMMER, *supra* note 63, § 2.08[B][3] n.106.2.

121. 632 F.2d at 993.

mary" importance to the consumer. Although this formulation would presumably exclude the design of most common useful objects, it too fails to provide a satisfactory approach to separability. Attempts to determine an article's "primary" attraction to consumers will frequently prove fruitless. There is no reason to expect anything approaching unanimity on such an issue, and even individual consumers generally will have mixed motives that cannot be neatly ranked in the required hierarchy. Does the "ornamental aspect" of an expensive sofa, for example, become "primary," and its utilitarian function "subsidiary," if its owner permits no one to sit on it?[122]

Professor Nimmer offers a still narrower model linking copyright to consumer appeal, suggesting that "conceptual separability exists where there is any substantial likelihood that even if the article had no utilitarian use it would still be marketable to some significant segment of the community simply because of its aesthetic qualities."[123] Professor Nimmer acknowledges, however, that his approach is not without its difficulties.[124] It cannot avoid the evidentiary problems that trouble all models emphasizing consumer judgments and motivations. Moreover, the difficulty with Nimmer's approach is particularly acute, since the standard generally will require conclusions concerning markets that do not in fact exist. The predictive nature of the inquiry can only underscore the significance of judicial perceptions of beauty and taste.

At a more fundamental level, it is not apparent why a willingness to purchase a nonfunctional version of the design *ought* to be the touchstone for protection. This standard, together with other variations on the marketability theme, is essentially a measure of the success or desirability of the design. Since the congressional decision to exclude industrial design per se from the scope of copyright reflects a desire to ensure vigorous competition in the marketing of commercial products, a test that predicates protection on the appeal or success of the design appears counterproductive. Marketability, whether or not considered apart from the utilitarian aspects of the article,

122. *See* George Hensher Ltd. v. Restawhile Ltd., [1974] 2 All E.R. 420, 430 ("I do not think that whether or not a work is to be regarded as artistic depends on whether or not the primary inducement for its acquisition or retention is its functional character.").

123. 1 M. NIMMER, *supra* note 83, § 2.08[B][3]. Such an approach had been suggested, and questioned, even before the Supreme Court's decision in *Mazer*. *See* Note, *Protecting the Artistic Aspects of Articles of Utility: Copyright or Design Patent?*, 66 HARV. L. REV. 877, 882 n.33 (1953).

124. 1 M. NIMMER, *supra* note 83, § 2.08[B][3].

is irrelevant to the legislative distinction between applied art and industrial design. The walls of numerous garages and basements, for example, attest to the attraction of well-polished hubcaps, yet that should not automatically remove such objects from the realm of industrial design.[125] On the other hand, works of applied art that are clearly copyrightable, such as graphic designs on china or fabrics, may well be unmarketable as pure works of art.[126] Attempts to equate the statutory requirement of separability with consumer assessments of merit or value are simply incompatible with the legislative decision to eschew aesthetic distinctions.[127]

The case law, however, offers one approach to the separability criterion that avoids reliance on aesthetic judgments, if only through the sheer irrationality of its distinctions. The theory is most extensively articulated in *Esquire, Inc. v. Ringer*.[128] In response to the plaintiff's claim that the designs of its outdoor lighting fixtures were copyrightable works of art, the Register of Copyrights argued that the overall shape of utilitarian articles is never eligible for copyright. Although technically decided under the 1909 statute, the Court of Appeals for the District of Columbia concluded that the Register's contention accurately reflected the scope of copyright under both the 1909 and 1976 Acts.[129] *Mazer* was of no help to the plaintiff, the court reasoned, because that case had dealt only with "a 'feature' segregable from the overall shape of the table lamps."[130]

The appeal of such an approach is obvious. It avoids the specter of copyright in " 'the whole realm of consumer products . . . and industrial products' "[131] without the necessity of appraising the artistic merits of their overall designs. The 1976 Act appears to offer some limited support for such an unbending approach. The definition of "pictorial, graphic, and sculptural works" refers to "features that can be identified

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125. *See* Norris Indus., Inc. v. Int'l Tel. & Tel. Corp., 212 U.S.P.Q. (BNA) 754 (N.D. Fla. 1981), *aff'd*, 696 F.2d 918 (11th Cir. 1983).

126. After viewing a photograph of one of the *Mazer* statuettes, *see* R. Brown, Kaplan and Brown's Cases on Copyright 135 (1978), one might well disagree with Professor Nimmer's conclusion that the statuette "would still be marketable to some significant segment of the community simply because of its aesthetic qualities," 1 M. Nimmer, *supra* note 83, § 2.08 [B][3].

127. *See* H.R. Rep. No. 1476, *supra* note 3, at 54-55.

128. 591 F.2d 796 (D.C. Cir. 1978), *cert. denied*, 440 U.S. 908 (1979).

129. *Id.* at 803.

130. *Id.* at 805.

131. *Id.* at 801.

separately,"[132] arguably alluding to something less than the overall shape of the useful object, even though this follows the statement "[s]uch works shall include works of artistic craftsmanship insofar as their *form* . . . are concerned."[133]

The *Esquire* rationale has been used to deny copyright protection to the overall shapes of numerous articles, including hubcaps,[134] mechanical games,[135] and toy airplanes.[136] It was also cited in the district court opinion denying copyright in the overall design of the Kieselstein-Cord belt buckles.[137] The complete excision of overall shapes suggested by *Esquire,* however, is difficult to reconcile with a considerable number of cases decided under the 1909 Act, and *Esquire* itself concluded that the 1976 revision merely codified existing standards.[138] The overall shapes of coin banks, for example, have consistently been granted protection when the prerequisites for copyright have been met, despite their apparent status as "useful

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132. 17 U.S.C. § 101 (1976) (definition of "pictorial, graphic, and sculptural works").

133. *Id.* (emphasis added). The legislative history similarly refers to "elements" that may be identified separately from the utilitarian aspects of the article. H.R. REP. No. 1476, *supra* note 3, at 55. The report further states that "copyright protection would extend only to that element, and would not cover the over-all configuration of the utilitarian article as such." *Id.* This, however, appears to be merely a statement of the simple truism that when only a portion of a work is copyrightable, the statutory protection extends to that portion alone. *Cf.* 17 U.S.C. § 103(b) (1976) (stating a similar principle for works containing non-original material). If the overall shape itself is separable from the utilitarian aspects of the work, the limitation is simply inapplicable. Indeed, the report itself speaks of copyright in works "employed as the design of a useful article." H.R. REP. No. 1476, *supra* note 3, at 105.

134. *See* Norris Indus., Inc. v. Int'l Tel. & Tel. Corp., 212 U.S.P.Q. (BNA) 754 (N.D. Fla. 1981), *aff'd*, 696 F.2d 918 (11th Cir. 1983).

135. *See* Durham Indus., Inc. v. Tomy Corp., 630 F.2d 905 (2d Cir. 1980).

136. *See* Gay Toys, Inc. v. Buddy L Corp., 522 F. Supp. 622 (E.D. Mich. 1981). Despite the court's unwavering confidence ("Clearly, without question, the defendant's toy airplane is both useful and utilitarian." *Id.* at 625.), its conclusion that the toy is a "useful article" is open to serious question. "A 'useful article' is an article having an intrinsic utilitarian function that is not merely to portray the appearance of the article . . . ." 17 U.S.C. § 101 (1976) (definition of "useful article"). Whatever utility the toy may have derives entirely from the fact that it portrays the appearance of an airplane, thus apparently falling squarely within the statutory exception. Reference to separability and independent existence is therefore unnecessary. *See, e.g.*, Monogram Models, Inc. v. Industro Motive Corp., 492 F.2d 1281 (6th Cir.), *cert. denied*, 419 U.S. 843 (1974) (copyright upheld in model airplane kit).

137. *See* Norris Indus., Inc. v. Int'l Tel. & Tel. Corp., 696 F.2d 918 (11th Cir. 1983); Kieselstein-Cord v. Accessories by Pearl, Inc., 489 F. Supp. 732, 735 (S.D.N.Y. 1980).

138. 591 F.2d at 803. *Accord* Kieselstein-Cord v. Accessories by Pearl, Inc., 489 F. Supp. 732, 735 (S.D.N.Y.), *rev'd on other grounds*, 632 F.2d 989 (2d Cir. 1980).

articles."[139] The shapes of pajama bags[140] and of molds employed in the manufacturer of ceramic figures,[141] together with ring boxes,[142] and the antique telephone shape utilized for the pencil sharpener in *Ted Arnold Ltd. v. Silvercraft Co.*,[143] have all been accepted for registration by the Copyright Office. The Second Circuit also repudiated the attempt to exclude the overall shape of useful objects from the scope of copyright in *Kieselstein-Cord*, in which the court held that the overall shapes of the plaintiff's belt buckles were copyrightable under both the prior and present statutes.[144] A more recent case indicates that the overall shape of eyeglass display cases may also be copyrightable.[145]

The distinction between product features and overall shape or design suggested in *Esquire* cannot be translated into a coherent model of the separability test. On a literal level, the "distinction" cannot be reconciled with the definitional structure of the 1976 Act. The statutory description of a "useful article" concludes with the statement: "An article that is normally a part of a useful article is considered a 'useful article.'"[146] Ex-

139. *See, e.g.*, Goldman-Morgan, Inc. v. Dan Brechner & Co., 411 F. Supp. 382 (S.D.N.Y. 1976); Royalty Designs, Inc. v. Thrifticheck Serv. Corp., 204 F. Supp. 702 (S.D.N.Y. 1962). *Cf.* L. Batlin & Son, Inc. v. Snyder, 536 F.2d 486 (2d Cir.) (en banc), *cert. denied*, 429 U.S. 857 (1976) (copyright in "Uncle Sam" bank invalid for lack of originality).

140. *See* R. Dakin & Co. v. A & L Novelty Co., 444 F. Supp. 1080 (E.D.N.Y. 1978) (stuffed toy animals used as pillows and pajama bags).

141. *See* S-K Potteries & Mold Co. v. Sipes, 192 U.S.P.Q. (BNA) 537 (N.D. Ind. 1976) (no judicial determination of copyright validity).

142. *See* Dan Kasoff, Inc. v. Gresco Jewelry Co., 204 F. Supp. 694 (S.D.N.Y.), *aff'd*, 308 F.2d 806 (2d Cir. 1962).

143. 259 F. Supp. 733 (S.D.N.Y. 1966). The court in *Esquire* attempted to distinguish *Ted Arnold* by arguing that the telephone casing could be physically separated from the sharpening mechanism housed within. 591 F.2d at 802 n.19. Indeed, the opinion suggests that if Esquire itself had specifically limited its application to the housing of its lighting fixtures, excluding the base, electric components and light bulb, a different case would have been presented. *Id.* at 806. The concession, however, completely undermines the overall shape rationale used to justify the court's decision. The Copyright Act itself precludes protection of the "mechanical or utilitarian aspects" of "pictorial, graphic, and sculptural works." 17 U.S.C. § 101 (1976) (definition of "pictorial, graphic, and sculptural works"). Mechanical entrails can be removed from a multitude of consumer and industrial products, leaving cabinets or casings that would then be entitled to copyright. If the elimination of wiring, transistors or gears is sufficient to satisfy the separability test, a broad segment of industrial design will fall within the scope of copyright. It is unlikely that the *Esquire* court would actually countenance such a result.

144. 632 F.2d at 994.

145. *See* Trans-World Mfg. Corp. v. Al Nyman & Sons, Inc., 95 F.R.D. 95 (D. Del. 1982).

146. 17 U.S.C. § 101 (1976) (definition of "useful article").

tending protection to even a "feature" of a utilitarian product, such as the design of a handle or control knob or, presumably, a lamp base, is thus by definition permitting copyright in the overall shape of a "useful article." On a more substantive level, the proscription against copyright in overall shapes or designs is not an accurate reflection of the legislative intent. Congress clearly did not wish to disturb the protection accorded the Balinese dancing figures in *Mazer v. Stein*.[147] Assume, however, that the plaintiffs operated a more diversified enterprise, offering in addition to their table lamps a companion cigarette lighter in which the head of an identical figure lifts to expose the internal mechanism. The statuette is now the overall shape of a useful article. It seems absurd to contend that the statuette is copyrightable in one context but not the other, merely because the utilitarian aspects have been internalized.[148] And if the point is conceded for a Balinese dancer, what of a more abstract form reflecting twentieth rather than nineteenth century visions? The only justification for the whimsical approach espoused in *Esquire* is the desire for a levee to hold back the flood. There are, however, more discriminating barriers.

III. APPLIED ART AND INDUSTRIAL DESIGN

A. The Design Process

The objective of the separability test, according to its legislative history, is to divide copyrightable "applied art" from uncopyrightable "industrial design."[149] Rational application of the standard thus requires some appreciation of the distinctive nature of industrial design.

In a sense, the origins of industrial design can be traced to the earliest attempts to fashion natural materials into more useful forms. Not until the Industrial Revolution brought the capacity to manufacture unlimited quantities of identical products, however, did a discreet conception of industrial design begin to emerge.[150] Initially, industrial design was little more than a belated attempt to conceal the patent ugliness prolifer-

147. *See* H.R. Rep. No. 1476, *supra* note 3, at 55, 105.

148. The legislative history suggests no such distinction. *See* H.R. Rep. No. 1476, *supra* note 3, at 105 ("copyright . . . will not be affected if the work is employed as the design of a useful article"). There is little reason to conclude that a Mickey Mouse telephone is beyond the reach of copyright merely because the electronics are located within Mickey's tummy.

149. H.R. Rep. No. 1476, *supra* note 3, at 55.

150. *See, e.g.*, K. Baynes, Industrial Design & the Community 10-11 (1967); V. Papanek, Design for the Real World 22-23 (1971).

ated by developing technologies.[151] This concept of industrial design as decoration, however, was gradually replaced by a vision premised on a more intimate relationship between the nature of a product and its appearance. In 1894, Frank Lloyd Wright declared that "the machine is here to stay," and challenged the designer to "use this normal tool of civilization to best advantage instead of prostituting it as he has hitherto done in reproducing with murderous ubiquity forms born of other times and other conditions."[152] The twentieth century soon saw industrial design become an integral aspect of product development.[153]

The dominant feature of modern industrial design is the merger of aesthetic and utilitarian concerns. It is the influence of nonaesthetic factors, the nexus between what the product must do and how it must look, that distinguishes true industrial design from other artistic endeavors. The industrial designer as engineer—a perspective no less valid than industrial designer as artist—is subject to the functional constraints inherent in each undertaking. The designer cannot follow wherever aesthetic interests might lead. Utilitarian concerns influence, and at times dictate, available choices. Indeed, aesthetic success is often measured in terms of the harmony achieved between competing interests.[154] The merger of aesthetics and utility defines the designer's craft, so that "[w]hatever else he is or isn't—artist, engineer, salesman, planner, management consultant, inventor—the industrial designer is a problem solver."[155]

The most obvious factor influencing and directing the designer's creativity is the necessity of accommodating the functional operation of the product. At its most fundamental level, this consideration simply excludes any form that significantly interferes with the utility of the article. Modern approaches to industrial design, however, generally seek a relationship be-

151. "Looking at the machine, they saw a new thing, a thing that seemed to cry out for decorative embellishments. These decorations were usually garnered from classical ornaments and from major raids into the animal and vegetable kingdoms. Thus, giant hydraulic presses dripped with acanthus leaves, pineapples, stylized wheat sheaves." V. PAPANEK, *supra* note 150, at 23.

152. *Id.*

153. *Id.* at 23-24.

154. "All design is a compromise of conflicting requirements and the most satisfying results are those where the priorities of the conflicting needs have been correctly assessed . . . ." F. ASHFORD, THE AESTHETICS OF ENGINEERING DESIGN 29 (1969).

155. INDUSTRIAL DESIGNERS SOCIETY OF AMERICA, DESIGN IN AMERICA 5 (1969).

tween form and function far more intimate than simple compatibility. Raymond Loewy, perhaps the design profession's most celebrated practitioner, speaks of the "natural form" and "self-expression of the machine."[156] The notion of form reflecting function is a basic tenet of contemporary design: "The best designs are those in which the appearance springs truly from the structure, and is a logical expression of it."[157] Perusal of any of the multitude of books collecting illustrations of "modern" design confirms the general acceptance of this fundamental credo.[158] The notion of expressing function through form differs in an important respect from the more primitive requirement that form be compatible with function, since the former is itself a purely aesthetic concern, expressing one conception of "good" design.[159] In this sense, the principle suggests limitations not unlike those imposed on any artist by internal or external conceptions of artistic merit or worth. When practiced, however, the principle operates to intensify the nexus between form and function.

Other utilitarian considerations can, of course, be identified: "[T]he following things should be treated respectfully: function, ease of operation, maintenance, cost of upkeep, storage, cost of manufacturing, packing, shipping, display, safety, fail-safe operations, . . . all these and more are involved in doing the job properly . . . ."[160] Such concerns can be served poorly or well, but they cannot be ignored. Their cumulative influence can render the designer's task quite unlike that confronting the painter or sculptor.

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156. R. LOEWY, *supra* note 86, at 13.

157. W. CAIN, ENGINEERING PRODUCT DESIGN 157 (1969). "One of the functions of aesthetics in engineering design is to indicate function and purpose." F. ASHFORD, *supra* note 154, at 13. "One might call the process beauty through function and simplification." R. LOEWY, *supra* note 86, at 47.

158. *See, e.g.*, K. BAYNES, *supra* note 150; INDUSTRIAL DESIGNERS SOCIETY OF AMERICA, *supra* note 155; R. LOEWY, *supra* note 86; PENTAGRAM DESIGN PARTNERSHIP, PENTAGRAM: THE WORK OF FIVE DESIGNERS (1972).

159. Other purely aesthetic considerations may, of course, be operative. The designer may feel constrained by current trends in fashion or taste. *See, e.g.*, F. ASHFORD, *supra* note 154, at 114-16; R. LOEWY, *supra* note 86, at 34. Aesthetic options may also be limited by a desire to maintain a particular corporate design style, *see* F. HENRION & A. PARKIN, DESIGN COORDINATION AND CORPORATE IMAGE (1966), or to relate the appearance of components or accessories.

160. R. LOEWY, *supra* note 86, at 18. *See generally* F. ASHFORD, *supra* note 154; W. CAIN, *supra* note 157; A. MOSS, SUCCESSFUL INDUSTRIAL DESIGN (1968); E. TJALVE, A SHORT COURSE IN INDUSTRIAL DESIGN (1979).

B. Copyright in Useful Articles

The legislative history describes the separability test as an attempt "to draw as clear a line as possible between copyrightable works of applied art and uncopyrightable works of industrial design."[161] In truth, of course, there is no line, but merely a spectrum of forms and shapes responsive in varying degrees to utilitarian concerns. Only a model appealing directly to the considerations underlying the separability standard can avoid purely arbitrary distinctions.

Taking *Mazer* as its touchstone, Congress sought to isolate pictorial, graphic, and sculptural works that are "incorporated into a product,"[162] or "employed as the design of a useful article."[163] Congress thus attempted to distinguish artistic works that are merely utilized in the design process from those that result from the process itself. The distinction could, of course, be implemented by excluding all works created with some utilitarian application in view, but this would overturn *Mazer*, together with a host of other eminently sensible decisions, in favor of an intractable factual inquiry of questionable relevance. Any such categorical approach would also undermine the legislative determination to preserve an artist's ability to exploit utilitarian markets.[164] Alternatively, the statutory directive requires a distinction between works of industrial design and works whose origins lie outside the design process, despite the utilitarian environment in which they appear. Copyrightability, therefore, should turn on the relationship between the proffered work and the process of industrial design. Because the dominant characteristic of industrial design is the influence of nonaesthetic, utilitarian concerns, copyrightability ultimately should depend on the extent to which the work reflects artistic expression uninhibited by functional considerations. Only such a direct assessment of the nature of the claimant's contribution can implement the congressional decision to exclude the general realm of industrial design, while preserving exclusive rights in "applied art."

Analysis of the relationship between form and function is not new to copyright law. In an effort to avoid monopolization of functional attributes, the law has long denied protection in instances in which utilitarian requirements *dictated* a particu-

161. H.R. Rep. No. 1476, *supra* note 3, at 55.
162. *Id.*
163. *Id.* at 105.
164. *See* 17 U.S.C. § 113(a) (1976).

lar form.[165] The relationship between form and function, however, is seldom so direct. Typically, a variety of forms will be compatible with functional objectives. The choice is thus constrained rather than dictated.[166] The separability test, devised to exclude industrial design from the scope of copyright, suggests that even this weaker relationship between form and function is sufficient to preclude protection. The statutory criterion limiting protection to "pictorial, graphic, or sculptural features that can be identified separately from, and are capable of existing independently of, the utilitarian aspects of the article"[167] should therefore be viewed as an attempt to identify elements whose form and appearance reflect the unconstrained perspective of the artist. Such features are not the product of industrial design; their form is not responsive to nonaesthetic interests. They are in this sense pure art, regardless of the context in which they appear. Two-dimensional graphic works appearing on useful articles, for example, do not fall within the statutory exclusion because their appearance is not affected by functional concerns. Only artistic motives influence the choice of flowers, birds, or geometric patterns. Similarly, the *Mazer* statuettes remain copyrightable despite their use as lamp ba-

165. *See, e.g.*, Brown Instrument Co. v. Warner, 161 F.2d 910, 911 (D.C. Cir.), *cert. denied*, 332 U.S. 801 (1947); Taylor Instrument Co. v. Fawley-Brost Co., 139 F.2d 98, 100 (7th Cir. 1943), *cert. denied*, 321 U.S. 785 (1944). "The Copyright Office has taken the position that calculating and measuring devices such as slide rules, wheel dials, etc. may not claim copyright where the elements appearing on the device (e.g., calibrations, numbers in regular progression, etc.) are necessary functional expressions of the underlying mathematical principle, formula or other 'idea.'" 1 M. NIMMER, *supra* note 83, § 2.08[D][1] n.158. Similarly, the Copyright Office has refused to register the patterns imprinted on integrated circuit chips because of "the danger that the desired protection could go beyond the purpose of copyright." *Hearings 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. (1979) (testimony of Jon Baumgarten, General Counsel, Copyright Office), *reprinted in* 2 COPYRIGHT L. REP. (CCH) ¶ 20,029, at 10,049 (1979). The limitation is sometimes implemented by holding that "forms of expression dictated solely by functional considerations" do not evince the originality or creativity essential to copyright. 1 M. NIMMER, *supra* note 83, § 2.01[B]. The attempt to avoid monopolization of functional characteristics is part of the more general attempt to preclude the extension of copyright to "ideas." *See* Baker v. Selden, 101 U.S. 99 (1879); Herbert Rosenthal Jewelry Corp. v. Kalpakian, 446 F.2d 738 (9th Cir. 1971); Morrissey v. Proctor & Gamble Co., 379 F.2d 675 (1st Cir. 1967); 17 U.S.C. § 102(b) (1976).

166. The distinction is explicitly drawn in recent design protection bills. Title II of the revision bill, S. 22, tit. II, *supra* note 6, would have afforded protection to an "original ornamental design of a useful article," *id.* § 201, but excluded "a design that is . . . dictated solely by a utilization function of the article that embodies it," *id.* § 202.

167. 17 U.S.C. § 101 (1976) (definition of "pictorial, graphic, or sculptural works").

ses, because their form is not responsive to utilitarian demands. Although created specifically for use in lamps, their form reflects purely aesthetic visions.[168]

The notion of distinguishing applied art from industrial design by examining the extent to which utilitarian considerations influence artistic expression has rarely surfaced in the case law. A few decisions make passing reference to similar ideas,[169] but the approach has never been used as a general model of the separability criterion. Yet no other model appears capable of successfully implementing the legislative decision to maintain unrestrained competition in the marketing of useful articles, subject only to an artist's exclusive rights in "incorporated" art.

A model emphasizing the influence of utilitarian factors frees the judicial analysis from its unfortunate fixation on appearance alone. If the ultimate aim is to distinguish applied art from industrial design, theories focusing only on appearances cannot achieve the desired end. It is the *process* more than the result that gives industrial design its distinctive character. Although the shape of an old-fashioned telephone, for example, would likely be excluded from copyright under any of the alternative interpretations of the separability test, what of the design of a pencil sharpener fashioned to present a similar appearance? The decision in *Ted Arnold Ltd. v. Silvercraft Co.*[170] to protect such a work may well be correct. Although

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168. This is not to say that whenever "the appearance of an article is determined by esthetic (as opposed to functional) considerations," H.R. REP. NO. 1476, *supra* note 3, at 55, it is therefore copyrightable. Such a standard would permit protection for virtually the whole of industrial design, in clear contravention of the legislative intent. It is the fact that the form of the *Mazer* statuettes is independent of their function, and thus unrelated to their utility, that "separates" it from the utilitarian aspects of the lamp.

169. In the case of costume jewelry, while the overall form is to some extent pre-determined by the use for which it is intended, the creator is free to express his idea of beauty in many ways. Unlike an automobile, a refrigerator or a gas range the design of a necklace or of a bracelet, may take as many forms as the ingenuity of the artist may conceive.

Trifari, Krussman & Fishel, Inc. v. Charel Co., 134 F. Supp. 551, 553 (S.D.N.Y. 1955) (copyright upheld in costume jewelry). "Plaintiff concedes that the dimensions it designed were limited by the dimensions of the pencil sharpener. But this does not mean that the antique telephone is merely utilitarian. There was still room here for considerable artistic expression." Ted Arnold Ltd. v. Silvercraft Co., 259 F. Supp. 733, 735-36 (S.D.N.Y. 1966) (copyright upheld in pencil sharpener casing). "The shapes of the toys and their dimensions and configurations also appear to have been dictated primarily by utilitarian considerations." Durham Indus., Inc. v. Tomy Corp., 630 F.2d 905, 915 (2d Cir. 1980) (denying copyright in "sculpture" of mechanical games).

170. 259 F. Supp. 733 (S.D.N.Y. 1966).

the appearance of the two products is similar, the creative process is not. In the context of a pencil sharpener, the form represents an essentially arbitrary conception responsive only to aesthetics.[171]

The perspective afforded by this suggested approach to the separability standard may explain the superficial appeal of many competing models. In some instances, for example, physical separability may underscore the unconstrained, artistic nature of a particular product feature. The ability to remove a hood ornament without affecting an automobile's performance evidences its purely aesthetic origins. Art equally divorced from utilitarian influence, however, may often escape such narrow vision. Two-dimensional graphic works are not in reality

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171. Emphasis on the creative process has long been part of copyright law, particularly with respect to objects claiming protection by virtue of their status as "works of art" (now "pictorial, graphic, and sculptural works"). "It is not necessarily a 'work of art,' something displaying artistic merit, but it is 'objet d'art'—something upon which the labors of an artist as such have been employed." Pellegrini v. Allegrini, 2 F.2d 610, 611 (E.D. Pa. 1924).

The current Copyright Office regulations require that "to be acceptable as a pictorial, graphic, or sculptural work, the work must embody some creative authorship in its delineation or form." 37 C.F.R. § 202.10(a) (1981). Although the process of industrial design is surely "creative" in a colloquial sense, the influence of nonaesthetic, functional considerations undermines the unfettered *artistic* creativity traditionally recognized by copyright. "That degree of creativity necessary to define objects as works of art is not supplied through innovations which are solely utilitarian or mechanical." Gardenia Flowers, Inc. v. Joseph Markovits, Inc., 280 F. Supp. 776, 781 (S.D.N.Y. 1968). "Illustrative of the requirement of minimal creativity are those cases which deny copyright protection to . . . forms of expression dictated solely by functional considerations." 1 M. NIMMER, *supra* note 83, § 2.01[B] (footnotes omitted). The significance of artistic freedom in the creative process was recently emphasized in connection with a legislative attempt to include within the scope of copyright the patterns imprinted on integrated circuit chips.

> The subcommittee should assure itself that—within the constraints of chip purpose and size—the designer's choice of a particular layout, and the representation of the designer's labors in the "photographic masks" and "imprinted patterns", is not dictated by the function to be performed by the chip and does represent a creative choice from among different possibilities. This standard is implicit in our assumption that the works to be protected are the result of "authorship."

Hearings 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. (1979) (testimony of Jon Baumgarten, General Counsel, Copyright Office), *reprinted in* 2 COPYRIGHT L. REP. (CCH) ¶ 20,029, at 10,049 (1979). Although the *outcome* of the industrial design process *may* not be *dictated* by function, one could argue that the influence of nonaesthetic concerns does indeed undermine the artistic creativity that marks the work of the sculptor or painter. The requirement of creativity may thus lend further support to a distinction between those shapes and configurations that are responsive to function, and those aspects of useful articles that are independent of utilitarian considerations.

physically detachable from the objects on which they appear. Three-dimensional shapes, whether coin banks,[172] pajama bags,[173] jewelry,[174] or pencil sharpeners[175] may also represent essentially arbitrary artistic conceptions, despite the absence of physical separability. Similarly, since utilitarian factors will significantly influence the overall shape of most useful articles,[176] a general rule of exclusion such as that expounded in *Esquire* is not without justification, yet it too sweeps too broadly.[177] Such draconian models can at best only approximate the distinctions pursued in the revision effort. Only direct reference to the legislative conceptions of "applied art" and "industrial design" embodied in the separability test can produce more discriminating results.

Emphasis on artistic independence has the additional advantage of neutralizing the arbitrary nature of the "useful article" characterization. The statutory category comprising articles "having an intrinsic utilitarian function" may yield too rich a harvest,[178] but works at the margin will generally survive inspection in any event. When utility is peripheral, as in paperweights or bookends, form is generally not significantly constrained by function, and thus the work will retain protection regardless of its characterization.

Attention to functional influences on form and appearance may also alleviate the de facto discrimination against nonrepresentational art that has regrettably accompanied much of the current analysis. It is difficult to quarrel with

172. *See, e.g.*, Goldman-Morgen, Inc. v. Dan Brechner & Co., Inc., 411 F. Supp. 382 (S.D.N.Y. 1976); Royalty Designs, Inc. v. Thrifticheck Serv. Corp., 204 F. Supp. 702 (S.D.N.Y. 1962).

173. *See* R. Dakin & Co. v. A & L Novelty Co., 444 F. Supp. 1080 (E.D.N.Y. 1978).

174. *See, e.g.*, Boucher v. DuBoyes, Inc., 253 F.2d 948 (2d Cir.), *cert. denied*, 357 U.S. 936 (1958); Cynthia Designs, Inc. v. Robert Zentall, Inc., 416 F. Supp. 510 (S.D.N.Y. 1976); Trifari, Krussman & Fishel, Inc. v. B. Steinberg-Kaslo Co., 144 F. Supp. 577 (S.D.N.Y. 1956); Trifari, Krussman & Fishel, Inc. v. Charel Co., 134 F. Supp. 551 (S.D.N.Y. 1955).

175. *See* Ted Arnold Ltd. v. Silvercraft Co., 259 F. Supp. 733 (S.D.N.Y. 1966).

176. *See, e.g.*, Durham Indus., Inc. v. Tomy Corp., 630 F.2d 905, 913 (2d Cir. 1980) (shape of mechanical games not copyrightable); Eltra Corp. v. Ringer, 579 F.2d 294, 297 (4th Cir. 1978) (typeface designs not copyrightable); Norris Indus. Corp. v. Int'l Tel. & Tel. Corp., 212 U.S.P.Q. (BNA) 754, 755-56 (N.D. Fla. 1981), *aff'd*, 696 F.2d 918 (11th Cir. 1983) (hubcaps not copyrightable); SCOA Indus., Inc. v. Famolare, Inc., 192 U.S.P.Q. (BNA) 216, 218 (S.D.N.Y. 1976) (shoe sole not copyrightable). *Cf.* Jack Odelman, Inc. v. Sonners & Gordon, Inc., 112 F. Supp. 187, 188-89 (S.D.N.Y. 1934) (copyright in drawing of dress gives no monopoly over the manufacture of the garment itself).

177. *See supra* notes 128-48 and accompanying text.

178. *See supra* notes 99-102 and accompanying text.

Judge Gesell's observation in *Esquire* that copyrightability ought not depend on adherence to particular artistic visions or styles.[179] There is no justification for limiting copyright to works reflecting aesthetic regimes in which the standard of merit is resemblance to external objects, while excluding those which seek virtue in the relationship of forms within the work itself. Yet, since the ordinary observer can more easily recognize a representational work that has been incorporated into a utilitarian object, emphasis on physical separability will frequently cause more abstract forms to be either overlooked or thought too "integrated" to satisfy the statutory requirement.[180] The general exclusion of overall shapes has a similarly pernicious effect. To avoid a crass or tasteless appearance, a utilitarian article is more likely to be given an abstract rather than representational form, although either may be arbitrary with respect to the underlying utility.[181] Thus a ban on copyright in overall shape will fall heavily on abstract forms, barring works whose origins may lie far from the practical influences of the design process. The discrimination is diminished, however, under a model that places direct emphasis on the relationship between form and function. The shape of a Mickey Mouse telephone is copyrightable because its form is independent of function. A telephone shape owing more to Arp, Brancusi, or Moore than Disney may be equally divorced from utilitarian influence. An abstract shape employed as a lamp base may embody an artistic conception as untainted by utilitarian concerns as the *Mazer* statuettes.[182] In all instances, unless the legislative distinction between applied art and industrial design is ignored, copyrightability must turn on the extent to which the

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179. 414 F. Supp. at 941.

180. The result does deny protection to designers who use modern three-dimensional abstract works artfully incorporated into a functional object as an inseparable aspect of the article while granting it to those who attach their independent representational art, or even their trite gimmickry, to a useful object for purposes of enhancement.

> . . . It is the originator's success in completely integrating the artistic designs and the functional aspects of the buckles that preclude copyright.

Kieselstein-Cord v. Accessories by Pearl, Inc., 632 F.2d 989, 994 (2d Cir. 1980) (Weinstein, J., dissenting from decision to uphold copyright in belt buckles).

181. "We may concede, for present purposes, that an interpretation of § 202.10(c) that bars copyright for the overall design or configuration of a utilitarian object will have a disproportionate impact on designs that exhibit the characteristics of abstract sculpture." Esquire, Inc. v. Ringer, 591 F.2d 796, 805 (D.C. Cir. 1978), *cert. denied*, 440 U.S. 908 (1979).

182. *Cf.* L & L White Metal Casting Corp. v. Joseph, 387 F. Supp. 1349, 1354 (E.D.N.Y. 1975) (infringement of lamp base castings).

work reflects either the independent perspective of the artist or the more integrated approach of the designer.

A model requiring assessments of artistic independence and utilitarian influence cannot offer the neat divisions promised by many of the alternative formulations. The distinctions drawn by current analysis, however, often prove illusory, or are maintained at too great a cost. The concepts of "applied art" and "industrial design" communicate the simple truth that some forms are more responsive to utility, and thus less the product of untrammeled aesthetic visions, than others. No mechanical test appears capable of capturing that relationship over a significant portion of the spectrum. Difficult judgments cannot be avoided, and only artificial divisions can succeed in making easy work of cases such as *Esquire* or *Kieselstein-Cord*.[183]

IV. CONCLUSIONS

When copyright in "pictorial, graphic, and sculptural works" ventures beyond the narrow confines of the "fine arts," the slope becomes slippery indeed. Current law expressly preserves exclusive rights in works of art applied to utilitarian ends, yet wisely endeavors to exclude the general design of commercial products. The distinction between copyrightable "applied art" and uncopyrightable "industrial design" has generally been pursued through mechanical models offering the seductive security of unbending rules and ostensibly objective

183. In *Esquire*, the Court of Appeals for the District of Columbia declined to venture beyond mechanical formulas. There was no attempt to assess the nature of the plaintiff's contribution. If its lighting fixtures had assumed the appearance of giant Balinese dancers, one can presume the court would have duly noted their conceptual independence. That the plaintiff chose a less horrific form does not exclude the possibility of a similarly untainted artistic conception. The task of judging the extent to which *Esquire's* forms reflect aesthetic decisions unrelated to function may be an unenviable one, but the legislative distinction between applied art and industrial design requires it. If the *Esquire* decision is correct, the credit is to chance rather than reason.

The Second Circuit's examination of Kieselstein-Cord's belt buckles is more promising. Although unable to articulate a coherent rationale for its conclusion that the sculptural designs were conceptually separable from the utilitarian aspects of the works, the court did not retreat to stock alternatives. Its intuition, and that of the Copyright Office which granted registration, appears well founded. Although clearly constrained in some respects by functional necessities, the buckles' overall shapes appear largely devoid of utilitarian influence, reflecting instead the purely aesthetic judgments of their creator. *See, e.g.*, Trans-World Mfg. Corp. v. Al Nyman & Sons, Inc., 95 F.R.D. 95 (D. Del. 1982) (expressing willingness to inquire into the conceptual separability of the shape of eyeglass display cases).

criteria. The arbitrary divisions inevitably engendered by traditional analysis, however, can only crudely approximate the distinctions pursued in the revision effort.

The Copyright Act of 1976 invites a more discriminating analysis. The standard of separate identity and independent existence encourages a thoughtful appraisal of the character of the claimant's contribution. The exclusion of industrial design from the scope of copyright is best understood as an attempt to bar forms influenced in significant measure by utilitarian concerns. Thus, copyright is reserved to product features and shapes that reflect even in their utilitarian environment the unconstrained aesthetic perspective of the artist. Nothing short of a candid assessment of the nature of the proffered work can successfully implement the prudent, yet fragile, distinction between applied art and industrial design.

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November 30, 1983

The Honorable Robert W. Kastenmeier
Chairman
Subcommittee on Courts,
Civil Liberties and the
Administration of Justice
U.S. House of Representatives
Committee on the Judiciary
Washington, D.C. 20515

Re: H.R. 1028 "Semiconductor Chip Protection Act"

Dear Mr. Chairman:

In your November 21, 1983 letter, you requested written comments for inclusion in the hearing record in respect of the subject bill, H.R. 1028. My comments are attached. Unfortunately, in view of time constraints, I was unable to address the issue of retroactivity. I have, however, taken the liberty of having the bill forwarded to other members of the Copyright Committee of the Patent, Trademark and Copyright Section of the D.C. Bar for further comment.

I appreciate the opportunity to place my views in the record.

Very truly yours,

CUSHMAN, DARBY & CUSHMAN

By Michael A. Lechter
Michael A. Lechter

MAL:slk
Enclosure

Comments of Michael A. Lechter, Partner, Cushman, Darby & Cushman, for inclusion in the hearing record regarding H.R. 1028, "Semiconductor Chip Protection Act of 1983," before the Committee of the Judiciary Subcommittee on Patents, Copyrights and Trademarks.

I am Michael A. Lechter, an attorney engaged in the practice of patent, copyright, and trademark law. I am presently a partner in the firm of Cushman, Darby & Cushman, a law firm specializing in intellectual property law. I have been involved in the organization of, and participated in, numerous professional sessions for the various sections of the Institute of Electrical and Electronics Engineers (IEEE), the IEEE Computer Society, and the Digital Equipment Computer Users Society, on the subject of protecting and exploiting technology; I have authored articles on those subjects for publication in, for example, IEEE COMPUTER, McGraw-Hill Datapro Applications Software Solutions, and Measurements and Control.

I appreciate the opportunity to place these comments regarding the "Semiconductor Chip Protection Act of 1983" in the record.

A Change in the Law is Needed

The process of developing a circuit layout is the subject of testimony by various witnesses already before the Committee. As is apparent from that testimony, the development of circuit layouts for a semiconductor chip is a relatively complex and expensive procedure, and the chip manufacturer has a legitimate interest in preventing competitors from appropriating its developmental work. When a competitor copies the circuit layout of a chip and can then market an identical chip without having to recoup the costs of developing the circuit layout and production masks, there can be no question that the developing company is placed at a substantial competitive disadvantage.

In general, practicable technology cannot presently prevent competing companies from reconstructing and copying the circuit layout and masks associated with a chip once the chip is placed on the market. Nor are any of the presently available legal protection mechanisms effective to protect the manufacturer's investment in developing the masks used to produce the chip. Notwithstanding the effort and cost of developing a mask, the mask is typically developed by straightforward application of standard engineering principles and generally does not meet the novelty and unobviousness requisites for patentability (35 U.S.C. 102, 103). Similarly, a mask typically does not constitute a work of authorship under the Copyright Act (17 U.S.C. 101 et seq.).

Thus, in order to protect the legitimate interests of the semiconductor industry in protecting investment in development of optimal circuit layouts and production masks and to provide incentive for innovation, it is clear that the present law must be amended.

H.R. 1028 is NOT Appropriate as Presently Written

Any change in the law, however, must be viewed not only from the perspective of protecting the interests of the manufacturer, but also from the perspective of the public interest. It is respectfully submitted that, while a change in the law to protect the legitimate interests of chip manufacturers is not only desirable, but necessary, H.R. 1028 as presently written establishes unduly broad exclusive rights in the manufacturer and should not be passed in its present form. H.R. 1028, rather than promoting innovation could conceivably have a stifling effect by prohibiting manufacture of competing chips using any mask "substantially similar" to the patterns of one of the images of a copyrighted mask work--irrespective of independent development (as opposed to copying) or rights which the public may have acquired in the mask.

H.R. 1028 purports to amend the "Copyright" Act (17 U.S.C.) to cover "semiconductor chip products, mask works, and masks," and provide an exclusive right respecting a mask

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for a period of 10 years. It is presumably intended that, at the end of the 10 years, the mask would pass into the public domain; that is, the public would acquire rights to the mask and the mask could be freely copied and used.

H.R. 1028, however, is subject to two basic infirmities:

(1) It overlooks the essentially functional, as opposed to arbitrary or artistic nature of masks and mask works, and that, accordingly, it is probable that a number of persons will independently develop substantially similar masks; and

(2) It provides for an overly broad exclusive right which can be obtained for any mask or mask work which is not substantially copied from another even though the mask or mask work is not novel, but does not limit the scope of the exclusive right to instances of actual copying.

It is significant that semiconductor chip designs are primarily functional, rather than arbitrary or artistic in nature; that is, the particular mask pattern tends to be determined in major part by the desired functional and structural characteristics of the chip which the mask is being used to produce. Certain design rules exist which dictate the minimum space between edges of elements in the chip (and thus the relative disposition of opaque and transparent portions of the mask). Computer-aided design techniques exist which facilitate design of optimized chip layouts. Since chip layout is primarily functional rather than arbitrary or artistic in nature, it is probable that a number of parties would independently apply the same standard engineering techniques to determine the optimum layout for a given circuit, and thus independently originate substantially similar masks. In this regard, masks and mask works are substantively different than the "arbitrary" works of authorship which have traditionally been protected by copyright. This gives rise to a major problem in that H.R. 1028 establishes an exclusive right for mask works and masks that is not limited to instances of actual copying, and thus would tend to suppress legitimate competition as well as "piracy."

Specifically, H.R. 1028 provides that the "exclusive right" provision of the Copyright Act, 17 U.S.C. 106, be amended to read, in pertinent part:

> "Subject to sections 107 through 118, the owner of copyright under this title has the exclusive rights to do and to authorize any of the following: . . .
>
> "(6) in the case of mask works--
>
> "(A) to embody the mask work in a mask;
>
> "(B) to distribute a mask embodying the mask work;

"(C) to use a mask embodying the mask work to make a semiconductor chip product;

"(D) in the manufacture of a semiconductor chip product, substantially to reproduce, by optical, electronic, or other means, images of the mask work on material intended to be part of the semiconductor chip product; and

"(E) to distribute or use a semiconductor chip product made as described in subclause (C) or (D) of clause (6) of this section."

The Act further provides (Sec. 2) that:

"A 'mask' embodies a mask work if the pattern of transparent and opaque portions of the mask is substantially similar to the pattern of one of the images of the mask work."

The exclusive right provision is overly broad and, notwithstanding the statements of various witnesses, H.R. 1028 may well preclude independent development of any competing chip using a substantially similar mask. Under the Act, there is no requisite that the mask be copied to constitute an infringement under the Act. By the language of H.R. 1028, it is merely necessary that the accused mask be "substantially similar" to the copyrighted mask.

Further, there is no requisite that the mask or mask work be novel to qualify for protection under the Act. The mask or mask work need only be "original" in the copyright sense of having "originated with the author"; see, for example, Alfred Bell & Co., Ltd. v. Catalda Fine Arts, Inc., 191 F.2d 99, 102 (2nd Circuit 1951). The mask need not be new--it is only necessary that the author not copy the work of another without providing at least a modicum of creative work.

Since novelty is not a prerequisite for obtaining protection, different parties can obtain the rights to the same design merely by independently developing the design. A manufacturer could, therefore, independently develop a mask which was already in the public domain (for example, a mask on which a previous copyright had expired), and still qualify for protection under the Act. The manufacturer would thus take something in which the public already had acquired rights away from the public. The 10-year term of a first copyright on a given design could expire, and another party independently develop the design and thus preclude the public from using the design for an additional 10 years.

Similarly, a plurality of parties can independently develop the same mask work and each concurrently claim copyright thereon. Since novelty is not a prerequisite for copyright protection, presumably each independent developer would qualify for the copyright, and each would obtain exclusive rights in the mark. However, since actual copying is not requisite for infringement under the Act, each could preclude the other from, inter alia, using the mask to make a semiconductor chip product. Thus, the anomalous situation arises where neither party can rightfully use the mask or mask work. It is noted, however, that the compulsory licensing provisions of Sec. 5 of the Act would presumably apply, and each would cross-license the other.

It is noted that novelty is not a prerequisite for protection under the present Copyright Act. However, the exclusive rights accorded the author under the present Act, in essence, are limited to preventing instances of actual copying. Further, the nature of the works of authorship protected under the present Act is "artistic" or "arbitrary," rather than being dictated by the function of an article, and thus independent origination of a substantially similar work is unlikely. With respect to H.R. 1028 and the protection of masks and mask works, however, it must again be stressed that independent development is made probable because of the utilitarian nature of the mask. Only a limited number, if not a single, circuit layout provides for optimization of the density of elements in a chip forming the circuit. Optimization of the circuit layout generally involves a straightforward (albeit complex and expensive) application of standard engineering principles. Thus, it is likely, particularly in view of computer-aided design techniques now available, that one or more parties could applying standard principles and techniques, independently and without knowledge originate a mask, notwithstanding the fact that a substantially identical mask has been in general use for some time.

Moreover, on occasion, a mask or mask work is completely dictated by the structure and function of the particular semiconductor chip product; that is, in order to provide a chip having certain characteristics (even aside from optimization) which meet industry packaging standards (for example, as to number and spacing of pins), a certain mask must of necessity be used. Thus, by copyrighting the mask, the "author" is, in such circumstances, obtaining de facto exclusive rights to the functional aspects of the chip. Such functional aspects historically have been protected by patent and thus subject to the safeguards of the novelty and unobviousness criteria of 35 U.S.C. 102 and 103.

For the above reasons, I strenuously oppose H.R. 1028 as written.

H.R. 1028 Should Be Amended,
or The Alternative Design Bill Approach Pursued

While H.R. 1028 as written is not appropriate, some new form of protection is imperative to protect the legitimate interests of the innovative semiconductor chip manufacturer. Accordingly, I would propose that the bill be amended at least in two respects. First, the Act should require that the mask or mask work be novel in the sense of the patent statute 35 U.S.C. §102. (No provision, however, need be made for examination in the patent sense. Novelty can be made a defense to be raised in the event of an action to enforce the copyright.) Secondly, and perhaps more importantly, the exclusive rights provided under Sec. 4 of the Act should be restricted to those necessary to prevent "pirating" of the manufacturer's circuit layout. Specifically, the exclusive rights should be limited to the rights to:

"(a) make or distribute copies of the mask or mask work;

(b) reproduce by optical, electronic, or other means, images of the mask work on material intended to be part of a semiconductor chip product in the manufacture of the semiconductor chip product; and,

(c) to distribute or use a semiconductor chip product made as described in subclause b of clause 6 of this section."

By so amending the bill, the legitimate interests of the semiconductor chip manufacturer against copying of their masks and circuit layout is served, without unduly impacting the public interest.

The Copyright Office Bill is a Viable Alternative

A specially tailored design law which is conceptually sound and not subject to many of the infirmities of H.R. 1028 has been advanced as an alternative approach to protect designs of semiconductor chips. The alternative approach, apparently prepared by the Copyright Office pursuant to Congressional request, adapts the "Design Bill" H.R. 2985 to apply solely to semiconductor chip products. The alternative bill differs substantively from H.R. 1028, inter alia, by limiting infringement to instances of actual copying and by precluding protection not only for designs that are not "original," but also for those designs which are "staple" or "commonplace," or only insignificantly different from designs that are staple or commonplace. Rights under the Act can be obtained, however, for designs that are not "novel"; that is, designs that are already in the public domain, although perhaps not yet staple or commonplace. Thus, the anomalous situation of a number of parties concurrently holding rights to substantially similar masks can exist under the alternative bill.

The fact that a party can obtain rights under the alternative bill in a chip design that was already known (and thus in which the public may have rights), is reflected in Sec. 908(e) which states:

> "(e) The party alleging rights in a chip design in any action or proceeding shall have the burden of affirmatively establishing its originality whenever the opposing party introduces an earlier work which is identical to such design, or so similar as to make a prima facie showing that such design was copied from such work."

If the party alleging rights proves that he independently developed the design, notwithstanding a publicly known earlier identical design, and the design is not "staple" or "commonplace," he presumably would have valid rights under the alternative bill. In this regard, it is suggested that the alternative bill be changed to preclude protection for designs which are not novel. Further, as a practical matter, it may prove difficult to establish whether a particular design is, or is not, "staple" or "commonplace."

Alternatively, if a "novelty standard" is not adopted, since there is no governmental examination, it would be appropriate to change Sec. 908(e) to place the burden of establishing that the mask is not staple or commonplace upon the party asserting rights in the mask.

In any event, however, the gravity of obtaining rights to an "old" design is minimized by the bill, in that infringement is restricted to instances where there has been actual copying of the protected chip design. Sec. 908(b) specifies:

> "(b) It shall not be infringement to make, have made, import, sell, or distribute, any semiconductor chip product embodying a chip design created without knowledge of, and copying from, a protected design. It shall also not be an infringement to make a copy of a protected design solely for the purpose of teaching, analysis, or evaluation." (emphasis added)

Similarly, Sec. 908(d) states:

> "(d) An infringing semiconductor chip product as used herein is any product, the design of which has been copied from the protected chip design, without the consent of the proprietor. A semiconductor chip product is not an infringing product if it embodies, in common with the protected design, only elements described in subsections (1) through (3) of section 902(a) [elements which are not original, staple or

commonplace, insignificantly different from staple or commonplace]." (emphasis and bracketed material added)

Thus, it is respectfully submitted that the alternative bill prepared by the Copyright Office pursuant to Congressional request is conceptually sound and by far more appropriate than H.R. 1028.

Summary

In summary, it is clear that the present law is inadequate to protect legitimate interests of semiconductor chip manufacturers against actual copying of their masks and mask works and co-opting of their developmental efforts. However, H.R. 1028 would create exclusive rights which do not merely protect against copying, but rather effectively create a patent-like monopoly on optimized chips without any requisite that the chip be new or unobvious. Moreover, since novelty is not a prerequisite for obtaining copyright protection and actual copying is not requisite for infringement under the Act, the essentially functional nature of the mask and mask work makes the spectre of plural concurrent or successive monopolies a reality under H.R. 1028. H.R. 1028 should therefore not be passed in its present form, but rather should be amended, at a minimum, to make novelty a prerequisite for protection and to limit the scope of the protection to instances of actual copying. Alternatively, the Semiconductor Chip Design Protection Act, prepared by the Copyright Office, should be pursued.

Michael A. Lechter

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Professor Alan Latman

November 30, 1983

DEC 09 1983

The Honorable Robert W. Kastenmeier
Chairman
Subcommittee on Courts, Civil Liberties
and the Administration of Justice
House Judiciary Committee
U.S. House of Representatives
Washington, DC 20515

Dear Chairman Kastenmeier:

As I have feared, my illness has permitted me to keep up with only teaching and other daily commitments. I have, however, given thought to your letter of October 24 and if it would be helpful (and not disrespectful) I would offer my "bottom-line" views on the questions you ask with a few supplementary comments. Perhaps in the future, at a time when it still would be helpful to the subcommittee, I can amplify these views.

(1) I think that there should be "some form of statutory protection for mask works and semiconductor chip products." I do <u>not</u>, however, think the basic approach of H.R. 1028 is sound because it attempts to fit protection for mask works generally within the principles of traditional copyright law. I am particularly concerned about the possibility of a "use right" creeping into the copyright law.

(2) I do <u>not</u> favor any retroactive protection for mask works. My concern may be mostly from a policy perspective but from a constitutional one as well. It is the same concern that caused me to be opposed to private law 92-60 approved December 15, 1961, pertaining to the works of Mary Baker Eddy. Public domain works should stay there. (The interim extension laws are more complicated and indeed did not raise questions of retroactivity, but I might still point out that I once argued on behalf of the Museum of Modern Art that the interim extension laws were unconstitutional as applied to the film "The Birth of a Nation.")

page two,
Hon., Robert W. Kastenmeier
November 30, 1983

(3) I would support incorporation of protection of designs of semiconductor chips as part of the long pending design bill such as H.R. 2985. I would, however, be opposed to limiting the scope of such a bill to chips. Indeed, there has been a tendency to look to the design bill as a home for a variety of works through the years before we got involved in chips. In my view, this shows that the design bill, which gives much shorter and much more limited protection than copyrights (as well as patents), would fulfill an enormous "leveling" need. In other words, it would avoid some of the extensions of copyright law that are arguably going on these days and yet would give short-term and effective protection to people who at the present time do not happen to be raising their voices as loudly as chip manufacturers.

I hope you will permit a personal observation. I have for a long time been under the impression that you do not share this view of mine, as to the desirability of a design bill, although you have not stated so publicly. My own suggestion is that the design question be confronted full-face so that its value for society can be assessed on its merits. My own suspicion is that mask works and a good deal of other material coming down the pike will fit quite gracefully into the bill, perhaps with modification.

As you know, the modifications of the bill have been legion through the years. I kind of think of it as having undergone an unofficial "make up" in the hands of such people as Barbara Ringer, Giles Rich, Pat Federico and a host of others. I think it would be counterproductive to utilize the structure only for one particular industry. I think it makes sense to evaluate fully whether the compromises and delicate balance effected by the design bill should not be available to all designs of useful articles.

Best personal wishes.

Sincerely yours,

Alan Latman

Alan Latman

AL:sg

November 16, 1983

The Honorable Robert W. Kastenmeier
Chairman, Subcommittee on Courts, Civil Liberties
and the Administration of Justice
Committee on the Judiciary
U.S. House of Representatives
Washington, D.C. 20515

Dear Representative Kastenmeier:

Thank you for the opportunity to comment on H.R. 1028; I'm sorry that it has taken me so long to compose a reply. This is partly because, as you no doubt apprreciate more thoroughly than I do, this legislation raises a number of quite difficult questions. I think that the fundamental difficulty arises out of the fact that masks for semiconductors so thoroughly destroy the distinction between what we might call works of expression and works of utility. The paradigmatic case for copyright law is I suppose, the novel, and the paradigmatic case for patent law is the machine. The mask work, a physical embodiment of abstract mathematical and logical relationships, like the computer program, is an instance of a phenomena which tests the boundaries of what intuitively appeared, at one point, to be distinct categories.

I would like to begin by briefly returning to first principles. The copyright and patent acts have, generally, the same objective; to protect and encourage capital investment in information, so long as that information has been embodied in a useful end product. Although there have been some rather trivial exceptions to this principle, the copyright law has generally extended protection to any marketable information product. It might, in my view, have been more convenient and conceptually clearer, if the copyright statute had recognized a distinction between aestshetic works and fact works, but no such distinction was explicit in the statute (though one can argue it is implicit in the interpretation of the standards). If, then, it is appropriate to protect telephone books, and tables of random numbers, I can see no reason to deny protection to masks for producing semiconductor chips. A mask for a semiconductor chip is conceptually very similar to, say, a map, or a set of architectural plans. Both maps and architectural plans have, of course, posed difficulty in the past, and I can see why the drafters of the bill (and, no doubt, the chip-industry) wish to have the benefit of clear definitions which will leave little room for judicial misinterpretation. And yet the possibility for error can never be eliminated; it can only be broken into smaller pieces. All of this is merely prelude to a question (which may prove rhetorical); why not simply amend the definition of "Pictorial, graphic, and sculptural works" to make it clear (though it may be true already) that the act is intended to apply to circuit diagrams, even

The Honorable Robert W. Kastenmeier
Page two
November 16, 1983

if the circuit diagrams are in a form which allows their more direct transformation into the final product than has been true for circuit diagrams drawn with ink on paper? The courts have, it seems to me, exhibited enough animosity toward misappropriators in the past to allow us to be confident that they will interpret the statute to forbid the direct copying of mask works or masks. The only reason for objecting to such a solution that occurs to me is that the authors of the bill wish more extensive protection than would be available by such a clarifying amendment. Since copyright in plans has not been thought to prevent the creation of the object of the plans (that is, while one may have a copyright in the architect's plan, copyright does not forbid building the structure, since the building is not regarded as a "copy" of the plan), such an amendment would not prohibit making the chip from a mask, though it would prohibit making other masks or mask works. And this, at last, leads me to observe that my commentary on this act must be fundamentally flawed — since it is not clear to me exactly what the problem is. If the evil at which the amendments are aimed is the reproduction of masks themselves, and their subsequent utilization, then copyright law provides an appropriate framework for a solution. If, on the other hand, the behavior which is targeted is merely the use of masks, or the circuitry itself, to reveal the architecture of the chip, then I wonder whether such prohibitions are consistent with copyright protection. But at this point, perhaps I should merely catalog my comments about the bill, and hope that the previous remarks can provide a context for the more pointed observations to follow.

1. I am confused by the definitons section. First of all, I don't understand the purpose of distinction between masks and mask works; is the distinction (which might be essential for engineers) equally essential for purposes of the copyright law? Also, I am puzzled by Subparagraph (3) under the definition of "semiconductor chip product"; it looks as if it is an effort to justify the bill under the commerce clause, as well as the patent and copyright clause, of the Constitution. I guess I object, and not simply because my sense of aesthetics is offended. Since the chip products are only indirectly protected by the bill, why is it necessary to bring chips within either of the enabling provisions? In order for the act to be valid, it seems that all that is necessary is that <u>mask works</u> and <u>masks</u> be within the class of constitutional "writings," and the previously mentioned (3) is merely confusing. And if protection is to be afforded a non-writing, then the Copyright Act is the wrong vehicle for providing protection.

2. I am troubled by Sec. 4, which contains the language intended to amend Section 1016. It introduces a new verb — "to embody" — which I assume is intended to mean something different from "to reproduce . . . in copies." Similarly, the insertion in Subparagraph (C) of "to use" as the operative verb simply compounds the confusion. As you know, the scope of the copyright law's protection has long been the source of argument. I have long told my students that mere "use" is not an infringement, the use must be of the forbidden variety before infringement occurs. I suspect that the ambiguity created by the introduction of new verbs to describe the forbidden act — to

embody, or to use — was intentional, and was intended to deepen the scope of protections. IF that is the intention, and IF it is appropriate to extend protection, then that must be made clear, which the bill fails, in my estimate, to accomplish. Perhaps the uncertainty could be reduced by the insertion of a clarification of the line between permitted and forbidden acts, of the form, "It shall not constitute a violation of the exclusive rights of the owner of a mask work to . . ." As it stands, I have very little idea just what the bill leaves as a permissible use. I believe that it would be bad policy to amend the copyright act so that the rights in mask works were functionally as deep as the rights available under the patent statute; it appears to me that the drafters of this bill have, perhaps, attempted to do just that, while avoiding the novelty and nonobviousness requirements. The limitation of the term to ten years suggests that this is not an unfounded suspicion.

3. I think I understand the motivation for the insertion of the compulsory licensing section, but I am skeptical. The workability of compulsory licensing seems doubtful, and in my opionion should be used only in cases in which a compelling need for it is demonstrated. It appears to me that the license here is intended to be a substitute for a more generous exemption from liability for innocent infringement. My preference would be for the more straightforward exemption, though my opinion here is relatively uninformed since, as I noted earlier, I don't have a very clear image in my mind of what kind of behavior has led to the need for regulation here.

4. I have no comment on the retroactivity question.

Generally, I think that relatively simple statutory language is preferable to statutory language that purports to anticipate every question, even though the former may require judicial elaboration. I honestly don't believe that much certainty is gained in statutes which contain elaborate definitions and intricate regulatory sections; the total amount of uncertainty is a constant and is simply fragmented and distributed throughout the regulation. The price paid for detailed regulation is that the law becomes less accessible, even to lawyers, let alone to non-lawyers.

I wish I had the time to provide a more scholarly, detailed, analysis of the bill, since it does raise a number of interesting questions. I hope you find my brief and informal comments of some value.

Yours truly,

John A. Kidwell
Professor of Law
University of Wisconsin Law School

JAK:bgm

July 30, 1983

Robert Kastenmeier
Chairman, Judiciary Sub-Committee on Courts ,Civil Liberties, and administration of Justice
House of Representative's
2137 Rayburn Bldg.
Washington, D.C. 20515

Dear Mr. Kastenmeier,

I am writing in order to respond to the article in the San Jose Mercury regarding the delay in the chip trial or should I say the hearing on the subject due to happen in Washington, D.C. on August 3, 1983. I understand that this hearing is supposed to introduce to Congress a bill aimed at protection of the semiconductor chip and its particular design by allowing the individual manufacturers to copywrite it.

This very idea was the reason for a very foul mood I found myself in just the other day. I am currently trying to study the micro-processor and the semiconductor in order to gain a fundamental concept of the subject. When one evening I found myself wonderiing why the "Hi-Tech" firms here in Silicon valley have not guarded their techniques more closely in order to insure that other elements of whom we are all aware, from stealing the technology and thus providing themselves with a competative edge in the marketplace. Since the industry is so competative and the company that can provide the cheapest and highest quality circuitry will in the eventual outcome be the leading competitor. It only made me angry and dissapointed in the individual and or the company that was not considering protection of their own individual design of their chips. As I am sure you are well aware in the last few years there has been a great deal of technological espionage. Particullary on the part of the Japanese who are dynamically duplicating the products that American research went into developing. In point of fact the Japanese were convicted of trying and suceeding in the buying of top level IBM computer secrets last year here in Silicon Valley. In my opinion any bill which protects the companies in the United States from such immoral acts should be adopted without hesitation. I will quote a national publication on the policies and new developments (ideas) of IBM and other companies. This quote is taken from INFORMATION SYSTEMS NEWS, published in Manhasset, New York. Quote from John Opel, IBM president, "Nothing is more important than being the low-cost producer especially in view of today's competition including some very efficient Japanese companies and their European partners." Information systems news went on to say: "Regarding Japanese competition, the front-page headlines about the arrests of Mitsubishi Electric Corp. and Hitachi Ltd. employess for alledgedly buying confidential information about IBM's H Series computers are still reverberating through the industry. Regardless of the ultimate outcome of the case, the 10-month undercover FBI investigation, aided by IBM, demonstrated the company's intense commitment to safeguard its secrets. It also served as a warning to competitors, especially, plug-compatible manufacturers."

These are my feelings on the subject of the bill, which I hope your committee will forward to Congress and hopefully they will adopt.

Sincerely yours,

Paul Todes

Paul Todes

CONNECTICUT PATENT LAW ASSOCIATION

December 21, 1983

The Honorable Robert W. Kastenmeier
United States House of Representatives
Room 2232
Rayburn House Office Building
Washington, D. C. 20515

H.R.1028: The Proposed Semiconductor <u>Chip Protection Act of 1983</u>

Dear Representative Kastenmeier:

The Connecticut Patent Law Association has adopted two resolutions and a report generally supporting the proposed Semiconductor Chip Protection Act of 1983, H.R.1028. A copy of the resolutions and report is enclosed with this letter.

In considering our views, we hope that you will take into account the experience within our membership in this area of technology. While not speaking on behalf of their employers, members of the Special Committee which studied this bill included patent attorneys of General Electric Company, United Technologies Corporation, and General Signal Corporation. Among our general membership are patent lawyers for most of the national corporations having major facilities or headquarters in Connecticut, many of which corporations are active in the development and use of semiconductor chips.

If you have any questions in the field or would like further information or assistance, please do not hesitate to call me or, preferably, the Chairman of the Special Committee, Charles P. Baker (212-758-2400).

We much appreciate the attention which you and your subcommittee are giving to legislation which seeks to strengthen protection for owners of intellectual property in this and other areas of technology.

Respectfully yours,

Denis A Firth

Denis A. Firth

DAF:maw
Enclosure

CONNECTICUT PATENT LAW ASSOCIATION

Resolutions Unanimously Adopted, December 7, 1983, and Report of the Special Committee of the Connecticut Patent Law Association to Study the Proposed Semiconductor Chip Protection Act of 1983 (S. 1201 and H.R. 1028)

Resolution No. 1:

1. The Connecticut Patent Law Association generally favors the enactment of the proposed Semiconductor Chip Protection Act of 1983 (S. 1201 and H.R. 1028).

Report and Comment on Resolution No. 1:

There is no question about the fact that semiconductor chips represent a prime example of a product which requires a great initial investment of intellectual effort relative to the cost of manufacturing the final device. Millions of dollars are spent designing masks for chips, but the chips themselves can be manufactured for a few dollars a piece.

Investments of this size must be protected. We are convinced that the present laws are inadequate to do so, and the proposed Act is generally satisfactory for the purpose.

Resolution No. 2:

2. The proposed Act should provide expressly for "reverse engineering;" we favor adoption of the language proposed in S. 1201, as amended by the Senate Subcommittee on Patents, Copyrights, and Trademarks.

Report and Comment on Resolution No. 2:

Provided there is a prohibition against pirating identical copies, and given the exclusivity which the patent laws grant for designs rising to the level of patentable inventions, the design and manufacture of competing chips is a great benefit to the electronics industry and the public.

Reverse engineering -- the practice of dissecting a semiconductor chip and reproducing its "mask work" in order to study the design or manufacturing process -- will encourage and accelerate such progress.

Without explicit statutory language, such as found in the Senate Subcommittee's amendments to S. 1201, the proposed Act and case law could prohibit desirable reverse engineering.

Report on a Third Area of Study

The Connecticut PLA's Special Committee has also considered whether the test of copyright infringement in the proposed Act --"substantial similarity"-- is too broad.

For example, a reverse engineered chip may have counterpart elements which do roughly the same thing as each element in an original chip, even though the visual patterns of the two chips are different. Most people who favor the proposed Act have said that its principal purpose is to prevent exact copying, and reverse engineering of this kind is acceptable. Such chips, however, could be considered "substantially similar" and therefore the second one could be held to infringe.

Moreover, the persons who design such a reverse-engineered chip could not use the traditional copyright defense of "independent creation", because they will have examined the original chip.

With further study, the Committee hopes to make a recommendation on this aspect of the proposed Act.

Charles P. Baker, Chairman

Thomas R. Fitzgerald
Maurice M. Klee
Eric Petraske
John R. Rafter
Frank J. Thompson

0500B

January 3, 1984

15 Silvermine Acres
Canton, Conn. 06019
(203) 548-2537

The Honorable Robert W. Kastenmeier
United States House of Representatives
Room 2232
Rayburn House Office Building
Washington, D.C. 20515

Re: HR 1028: The Proposed Semiconductor Chip Protection Act of 1983

Dear Representative Kastenmeier:

I agree with your reported opinion that the application of present copyright law to utilitarian objects presents significant problems.

In particular, the Senate bill (S 1201) gives to the industry a greater portion of the public domain than they have asked for. I enclose a draft resolution submitted to the Connecticut Patent Law Association on that point.

In general, present copyright law does not fit the needs of the industry, since semiconductor chips are designed under severe constraints that limit the ability of a designer to "express" an idea. This argument is developed in the enclosed article that will shortly appear in the Journal of the Patent Office Society.

Please circulate this letter and enclosures to interested members of your committee and to the committee staff. If I can assist you with any further explanation, do not hesitate to call me.

Very truly yours,

Eric W. Petraske

Eric W. Petraske

Enclosure A

Draft Resolution

Resolutions and Report of the Special Committee of the Connecticut Patent Law Association on the Proposed Semiconductor Chip Protection Act of 1983 (S. 1201 and H.R. 1028)

Resolution No. 3:

The current version of S. 1201 does not carry out the intent of the framers of the bill with respect to the scope of infringement and should be revised.

Report and Comment on Resolution No. 3:

The knowledge gained in the reverse-engineering process is routinely used to design a new integrated circuit that may be identical to or only remotely resemble the original design that was reverse-engineered.

The present version of S. 1201 will effectively suppress the production of identical copies, but the authors of the bill have further testified that their intention was to permit the fabrication of a functionally equivalent chip (in which each and every element of the original circuit has a counterpart that does exactly the same thing) in which the visual patterns are different.

In our opinion, this process would clearly result in a "copy" under the present copyright term of art of "substantially similar" that is included in the proposed definition of "mask" in the bill. The reverse-engineering process establishes access and the functionally equivalent chip would not only be "substantially similar", it would have the ultimate degree of "comprehensive non-literal similarity" (using the terminology from Nimmer on Copyright 13.03). The defense of independent creation is not available because the designers of the functionally equivalent chip have carefully studied every feature of the original design, so that the creation cannot be independent. Unless there is a clear direction from Congress that a different criterion should be used for semiconductor chip products, the case law on infringement will cripple the essential process of adapting and improving old designs by producing non-identical reverse-engineered products.

The present bill has already made a clear distinction between prior copyright and copyright for semiconductors by establishing in the definitions a new term "embody" that substitutes for "copy" for masks and chip products, so the proposed change is merely additional to an existing distinction.

We respectfully suggest that the definition of a right of reverse-engineering in paragraph 119 of the bill have a second paragraph that clearly sets out the dividing line between the permissible production of functionally equivalent chips and infringing production. The suggested version of paragraph 119 is:

"Paragraph 119. Scope of exclusive rights:

Right of reverse-engineering with respect to mask works

(a) In the case of mask works, the exclusive rights provided by section 126 are subject to a right of reverse-engineering use under the conditions specified by this section.

(b) (i) It is not infringement of the rights of the owner of a copyright to a mask work to reproduce the pattern on one or more masks or in a semiconductor chip product solely for the purpose of teaching, analyzing, or evaluating the contents or techniques embodied in the mask or semiconductor chip product, or the circuit schematic, logic flow, or organization of components utilized therein;

(b) (ii) <u>Nor is it infringement of the rights of the owner of a copyright on a copyrighted mask work to perform the acts listed in paragraph 106(6)A through 106(6)E provided such acts are performed as part of the design, production or distribution of a semiconductor chip product having one or more derivative masks associated therewith, at least one of which derivative masks embodies said copyrighted mask work, provided that (a) said derivative masks have derivative patterns produced with the aid of the analysis or evaluation specified in paragraph 119(b)(i) above and (b) no substantial portion of said derivative patterns is substantially identical to a corresponding portion of the pattern of one of the images of said copyright mask work."</u>

These changes establish that identical copying ("fragmented literal similarity" - Nimmer 13.03) of even a portion of a mask is an infringement, but that the degree of resemblance required to establish infringement of an original design by a reverse-engineered design (by "comprehensive non-literal similarity") must be much greater than that required under present case law.

COPYRIGHT FOR MACHINES - AN OXYMORON*

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COPYRIGHT FOR MACHINES - AN OXYMORON

I. Current Interest in the Copying Problem

In the past several years, there have been two attempts to extend copyright protection to the "masks" used in fabricating integrated circuits,(1) and a bill was reintroduced in Congress in January, 1983. The effect of the bill would be to bring a class of functional devices, collectively referred to as machines(2) within the scope of copyright law.

Until recently, it has been understood that copying a machine without infringing a patent or "passing off" is a nuisance which the originator has to endure. In many industries, some companies do not attempt to innovate, but merely copy designs from some of their competitors. In relatively recent times, it has become possible to dissect an integrated circuit chip, to photograph the various layers of semiconductor material and to fabricate an exact copy of the chip, or the machine which is embodied in the chip, with a rather short turnaround time and with a greatly reduced development effort compared to the job of developing a new chip from scratch. Copying is made easier by the existence of a number of specialist companies that will perform the dissection and generate a set of masks. The potential copyist thus need not develop reverse-engineering expertise of his own.

This article will discuss the problems inherent in applying copyright principles to machines and will outline a suggested form of protection that will achieve a reasonable balance between the needs of the innovator and those of his competitors. An indication of the problems to avoid will be found in a British case in which copyright protection for automobile mufflers has been litigated.

II. Public Policy - Justification

Public policy has long favored the free flow of information and the use of information to enable one company to improve upon its competitor's product and to produce either an improved version or a competitive version at a lower price. Especially in the field of patent law, it is not difficult to find forceful statements to the effect that patent exclusivity is granted to the inventor only in exchange for a good idea and that public policy strongly discourages the issuance of exclusivity for anything less than that. One example among many is: "Sharing in the good will of an article unprotected by patent or trademark is the exercise of a right possessed by all - and in the free exercise of which the consuming public is deeply interested."(3)

Following Kellogg, the case quoted above, the Supreme Court stated in Compco "Today we have held in Sears, Roebuck & Co. v. Stiffel Co. supra, that when an article is unprotected by a patent or a copyright, state law may not forbid others to copy that article. To forbid copying would interfere with the federal policy, found in Art. I, Sect. 8, cl. 8, of the Constitution and in the implementing federal statutes, of allowing free access to copy whatever the federal patent and copyright laws leave in the public domain."(4)

For the purposes of this article, it will simply be assumed that the technological change of photographic copying, with the consequent reduction of lead time available to the innovator is sufficient justification for taking from the public, for a limited time, the right to make a copy. It is, of course, an open question as to what types of machines, if any, should be protected by copyright and what scope of protection should be afforded.

It is also an open question, in the Author's mind, as to the appropriate legal framework within which the innovator should be protected. There are at least three possibilities: a modified patent; unfair competition; and copyright.

Patent protection for integrated circuits is and has been available, of course. The fact that the industry is attempting to obtain a new form of protection indicates that the protection of the present patent system is regarded as insufficient, although a modified patent could be appropriate.

Whatever other factors may have influenced the industry, there is a practical difficulty in that the time required to issue a patent, litigate it and appeal (at least four years) is enough to render patents ineffective in protecting lead time. There is a further, theoretical, difficulty in that the patent system has developed to cover the use of all of a number of equivalent ways of practicing an invention, but the problem perceived by the industry is that of producing an exact (photographic) copy of one particular version. Even if a quasi-patent with a registration system and without an intellectual standard(5) were to be introduced, the Bar and the Bench would have to unlearn the law that has developed on infringement.(6)

Since the type of competition in the semiconductor industry has changed (or is perceived to have changed) in that the increased ease of copying has reduced the lead time enjoyed by an innovator, it would seem natural to place a change in the rules of competition within the framework of unfair competition law by requesting the Federal Trade Commission to rule that copying of integrated circuits is a method of unfair competition (as it is empowered to do under 15 USC par. 5). Whatever the merits of this approach from a theoretical point of view, it is not likely to appeal to practical men contemplating the difficulty of getting a bill through Congress.(7)

Placing lead time protection in the framework of the copyright law offers readily apparent practical advantages, in addition to following the suggestion in Compco. The law has developed to prevent copying, which is the perceived problem. The existing system uses a registration procedure, so there is no time delay in obtaining protection and essentially no risk that the protection will prove to be illusory - a risk that plagues patent enforcement.

III. Copyright Framework

If lead time for products in the semiconductor industry is to be protected by copyright, it is prudent to devote some thought to the results that may be expected when the courts apply copyright principles to these products. The title of the article was selected to bring to the reader's attention the difference between a literary work and a machine which is constrained(8) to perform some function in a way that does not occur in literature. It would be surprising if principles developed to protect expressions in the arts operated to satisfy the very different needs of industry.

Copyright developed historically from the assumed absolute right of an author to control his artistic expression and to protect the result of his creativity. For hundreds of years, the courts have routinely granted injunctions against plagiarists and stripped them of their profits. The "framework" of copyright, by which is meant the body of theory, assumptions, attitudes and standard practices that accompany practice in the copyright field, developed in a literary environment and is different from that of patent and unfair competition, as one expects.

Three elements of this framework have been selected from the vast body of copyright law and are stated in highly condensed form and then expanded below:

a) the distinction between an idea and its expression;

b) the use of "substantial similarity" to establish that copying has taken place; and

c) the use of "substantial and material" as a threshold test for infringement.(9)

a) It is one of the fundamental principles of copyright, now imbedded in the copyright statute 17 USC 102(b), that "In no case does copyright protection for an original work of authorship extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, embodied in such work", but what is protected is the particular expression of the idea, etc. that has been copyrighted.(10) This quotation rests on the assumption that one can distinguish an idea from its expression - the idea being available to all and the expression being reserved to the author. This assumed distinction tends to justify harsh treatment of plagiarists by supplying the rationale that the public loses nothing by giving exclusivity to the author because the same message could be given to the public by another, in a different form.

b) In copyright enforcement, a key concept in establishing that copying has taken place is the comparison of the two works. If "substantial similarity" is found between the two, as well as access, then copying is presumed.(11) This test arose by necessity. In literature, protection limited to word-for-word copying would be illusory because it is easy for a plagiarist to make trivial modifications and still appropriate the author's efforts.

These two concepts, the idea/expression distinction and substantial similarity, work together consistently in the literary fields because the ideas that are transmitted may be more or less cleanly separated from the literary or artistic expression of those ideas.(12)

A literary work, according to Learned Hand's classic formulation, can be described on at least three different levels of abstraction, ranging from its exact words (least abstract) to the barest outline of the plot (most abstract), with at least one level of paraphrase in-between.(13) The dividing line between the idea and the expression will be on one of the intermediate levels. Selection of what degree of abstraction infringes is well known to be difficult and is done on a case-by-case basis. Word for word copying is clearly prohibited and the use of the most abstract level is clearly permitted.

c) It is well established (14) that, once copying has been determined, there is a threshold test for infringement. Only if the matter copied is "substantial and material", in the eyes of a layman, is infringement established.

IV. Copyright for Non-Literary Works

In a case where the choice of words or the details of the work is not the artistic expression of the author, but rather is dictated by external considerations, then copyright principles do not work because it is then impossible to separate the idea from the expression.

In the most pertinent case, Morrissey v. Procter & Gamble, 379 F2d, 675 (1967), the subject was an entry form for a contest based on the entrant's Social Security number and it had been established that there were only a few possible ways to put the information required for a contest (the number and the entrant's name, address and telephone number) on a piece of paper. The court followed the implications of Baker v. Selden to hold that, where an idea may be expressed in only a few different ways, that idea may not be protected by copyright.(15)

In a technical example, under the 1980 revision of the Copyright Act, computer programs are now subject to copyright protection.(16) A program to control the processes in an oil refinery could be copyrighted, and a plagiarist could be found liable for an infringement if there is something in the program that is not a "process", in the sense of 17 USC 102(b).

Two programs which are written independently of one another to control the operation of identical refineries, would be highly similar because the refinery processes being controlled are exactly the same. The multiple levels of abstraction referred to by Learned Hand in Nichols above become in this case; a) the actual computer statements written by the programmer, and b) ---n) flowcharts of varying levels of detail. The most detailed flowchart will not be the "creative" work or the expression of the programmer, but is determined by the process being controlled. The statute requires that only the computer code (lowest) level of abstraction may be protected by copyright because that is the only level that might be the "expression" of some idea or process (and there may be some things at that level that are the only way to perform a flowchart step and are thus not protectable under 102(b)). The legislative history of 102(b) makes it clear that Congress intended to avoid protecting the process carried out by a computer program.

The reader will readily appreciate that, in the case of technical works, there will be difficulty in applying the rule for determining infringement: the trier of fact, without the aid of expert testimony, assesses the response

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of the "ordinary lay observer". In order to perform his function, the trier of fact would have to understand what the process is and how it works, at the most detailed flowchart level, in order to distinguish between the flowchart ideas which are not protectable and the expression of those ideas which is the small remainder of the program. This process will be more difficult than making a decision in a literary copyright action because the trier of fact should (if he can) master both the technical field of the program and the programming language well enough to distinguish what is the programmer's style from what is determined by the process. It is possible (in principle) because programmers have individual styles, and will express process steps in different ways. Even if the Courts follow the guidance of the Federal Rules of Evidence 702, 704 to create an exception to the "lay observer" rule and permit expert testimony on the question of infringement, there will remain the intractable problem of applying tests that were developed for literary works that are meant to affect the reader's senses and emotions to machines that perform some function.

These examples were presented to show that copyrightable subject matter can be present in a technical work that is not a machine, and that the difficulty in reaching a fair decision will be considerable.

V. Copyright For Machines

In the case of a well designed machine, the idea/expression distinction does not work because there is no level of abstraction that contains only expressions of ideas that appear on a higher level and contains no new ideas of its own.

In integrated circuits, the levels of abstraction in Learned Hand's formulation become: The block diagram level, setting out the functions the various sub-circuits perform; the schematic [17] diagram level, setting out in conventional symbols the individual components and their electrical connections, but not the geometric aspects of the circuit; and the mask level, setting out the electrical connections and also the size, shape and placement of the components. There will be many possible schematics that could implement the block diagram and many possible sets of masks that could implement any one of the schematics.

As an example, consider a memory chip that has a block diagram with a block for a decoder circuit that selects an individual memory cell in response to the cell address, reflecting the idea of selecting the cell. At the schematic level, there will be several possible schematics that will do the job. Also at the schematic level, there will be different ideas for circuits - ideas that are not shown at the block diagram level. A particular circuit configuration has an idea of its own. There may be 1, 10 or 100 different circuits that will perform the decoding function of the block in the block diagram and there will be a corresponding 1, 10, or 100 different "circuit ideas". Each "circuit idea" will be a method of expressing a "block idea". Even if there are enough "circuit ideas" to avoid the rule of Morrissey,[18] it does not follow that a particular circuit may be protected under copyright as an expression of the block idea because copyright protection for that circuit may monopolize the circuit idea that is represented by that circuit. In this particular case, the rule of Morrissey is that: only if the circuit idea of a circuit may be expressed at a more detailed level of abstraction (the mask level) by more than a "few" expressions may that circuit be protected under copyright.

The process may be continued to the last step. The mask level is the most detailed level, containing not only the electrical information, but also the geometric information on component placement, size and shape. If there is an idea represented on the mask level ("mask ideas" will typically be about the geometric aspects of the chip and/or the effect of the geometry on the electrical properties of the circuit), then protection of the mask must be scrutinized under Morrissey to determine if protection of the mask will monopolize the "mask ideas" that appear in the mask.

Since the mask level is the most detailed level, protection of a particular mask will monopolize the mask ideas that are present in the mask because there is no more detailed level on which the mask idea can have many expressions.

A mask may carry information relative to hundreds of thousands of transistors and capacitors. It is not necessary to argue that every one of the many "mask ideas" that would be carried by a mask should be scrutinized under Morrissey. Most of these "mask ideas" could be dismissed as de minimus and it would not be worth anyone's time to protect them.

Some mask ideas can be extremely important and valuable, however, and there should be some way to distinguish between them. It is suggested that a mask idea be excluded from the Morrissey test (and thus that the mask features that carry a representation of the mask idea be protected under copyright) if the mask idea "doesn't matter" to the chip, i.e. if there are many other ways to perform the function in question that are equally fast, durable, small, easy to manufacture, etc. A typical example of a "doesn't matter" feature would be the routing of wires on a chip.

The standard analogy to literature breaks down when the mask level is discussed, because the choice of words in a novel or play can only express an idea. A particular word cannot carry an idea of its own (except for its definition). In integrated circuits, the lowest level of detail (analogous to the exact words of a novel) can carry ideas.

If it is accepted that a circuit feature at the mask level may be protected, according to the authority of Morrissey, only if the feature makes no difference to the performance of the chip, which is equivalent to saying that the feature is only an expression of some more abstract idea and carries no idea of its own that rises above the de minimus level, then the mismatch between copyright law and machines that must function becomes starkly apparent.

Every component of a well designed machine will have a function to perform and will be the particular form that it is because of a trade-off between various parameters (speed, durability, cost of manufacture, etc.). Those portions of the machine that are the most important will be the most carefully designed. It is in these important areas that the most valuable mask ideas that do matter to the chip are likely to be found. Under present copyright law, the most important portions of the masks of a well-designed integrated circuit will be denied copyright protection because such protection would effectively monopolize the ideas that are carried by the mask.(19)

Even if the problem with 102(b) is assumed away, there will be difficulty in proving copying. The substantial similarity test for copying does not work (or works too well) in the case of integrated circuit machines, because it is expected that competent engineers will produce a similar design to solve a particular problem. In literature, one may reasonably infer copying from similarity because nothing forces the choice of words. For machine design, a similar solution merely implies that both designers used the same idea, not that one copied the other.

The concept of substantial similarity, as it is known in conventional copyright, must then be drastically limited when applied to machines, or else a manufacturer who has, in fact, not copied anything that is not in the public domain, but has independently solved the same problem as his competitor using the same ideas will be at risk of losing a copyright suit because his competitive chip is highly similar to his compe itor's chip.

The third element of copyright - the threshold test for infringement in the eyes of a lay observer will obviously be extremely difficult or impossible to apply.

The application of copyright principles to machines can be clarified by considering three hypothetical cases:

A. The defendant's device is an exact copy of plaintiff's device (such as one reproduced by photographic means). The product that results will not only be similar, it will be identical and the question of copying will be determined without question.

The defendant may argue under 102(b) that he has taken nothing that is subject to copyright protection. It will then be necessary to separate those features protectable under 102(b) (perhaps the location of logical blocks on the chip and the connections between them) from those that are not protectable, before the infringement test may be applied. Photographic copying implies that the whole of the author's copyrightable contribution, however small it may be, has been taken, but it may well be the case that the portion of the chip that is protectable is so small that infringment will not be found even for an exact copy.(20)

B. The defendant has reengineered plaintiff's device; i.e., he has dissected the original chip, made a schematic diagram, and redone the layout(21) of that schematic diagram using a new team of employees who have not seen the original layout. The defendant has therefore copied the machine in the dictionary sense at the second (schematic) level of abstraction. The machine will be electrically identical, i.e. it may replace exactly the plaintiff's device. The layout done by the second team will be likely to bear a close resemblance to plaintiff's layout since the second team is working with the same constraints as the first and is not (by hypothesis) attempting to disguise the resemblance by placing elements of the chip in unnatural positions. Copying will presumably be found under the "substantial similarity" test. Infringement would presumably be found, as the two chips will be similar and are functionally equivalent.

It is suggested that the defendant should not be found liable for copyright infringement because he has taken only Plaintiff's ideas and is therefore protected by 102(b). The foregoing sentence may be restated in Learned Hand's model of levels of abstraction, as suggesting that what Defendant has copied is at too high a level of abstraction - the schematic level - and such abstract subject matter may not be protected by copyright.

The schematic diagram level of an integrated circuit is considerably more abstract than the layout level. Using our now familiar analogy, the schematic diagram of a circuit is comparable to an outline of a novel. It conveys detailed information about the structure of the novel (circuit), but different authors will choose different words for the characters (make one particular layout out of many different ones). Since the schematic level of abstraction leaves out the size and shape of the components, their geometric relationship, current and voltage capacities, and the thickness and composition of the layers of chemicals, a copyright on the mask cannot protect the schematic any more than literary copyright can protect the outline of a novel. Protection of ideas at this level of generality should come from the patent system.

C. If Defendant has used a portion of plaintiff's machine (by photographic copying) but has redesigned another portion by developing a different schematic, then some copying will have been established (although section 102(b) would permit the defendant to argue that he is permitted to do some or all of that copying) and the question will arise whether the amount taken has met the substantial and material test for infringement. Consider a case where Defendant has improved on Plaintiff's RAM (random access memory chip) by copying the memory cells photographically, but has designed his own improved decoding system for the addresses of the memory cells. Defendant's original work is a small portion of the area of the chip, but has substantially improved its performance. Courts have routinely found infringement in literary cases based on such facts - damages being based on an accounting of that portion of the defendant's profits that are deemed to have come from the use of the copyrighted material.

This sort of procedure - improving upon your rival's design by adding modifications of your own - is thought to be definitely encouraged by public policy in this country, yet application of copyright principles would result in judgment and, very likely, an injunction for the plaintiff. A manufacturer following the long established practice of coming out with an improved model can have no way of knowing if a lay jury or judge will decide that his product has crossed an undefined and indefinable threshold of appropriation.

The only situation in which the questions of copying and infringement can be settled clearly is that of a photographic exact copy. A photographic copy has clearly been copied and, since everything has been taken, the plaintiff's total expression (however small or large it may be) has also been taken.

In the other situations, it has been argued, the public interest in progress and the development of the useful arts requires that rival manufacturers be free to adapt and improve on unpatented designs.

VI. Pending Bill

The bill, HR 7207, which was introduced in the House in 1982 and was reintroduced in January, 1983 as HR 1028, provides for copyright protection of integrated circuit masks for a term of ten years and for a compulsory license to a purchaser of infringing chips under certain circumstances. The term of ten years is longer than the useful commercial life of most designs. The bill, therefore, should not be regarded as protecting a design against copying only during a lead-time period. The compulsory license is available to a good-faith purchaser who is not able to obtain chips from the copyright owner or from licensed manufacturers. It enables him to have infringing chips made (and pay a royalty) so that he is not forced to discontinue manufacture of products that use infringing chips. This feature is obviously necessary to avoid damaging third parties, though there will be few instances where the copyright owner cannot supply the customer.

In order to effect this protection, the bill simply inserts the category of semiconductor masks into the list of protected works(22) and therefore all the copyright "framework" will be applied to the protection of semiconductor chips. The foregoing hypothetical examples have illustrated some of the problems to be expected.

In particular, plaintiffs will routinely attempt to prove copying by comparison of two chips and searching for "substantial similarity" between them. It has been argued above that one would expect that independently designed chips which perform the same function will appear quite similar to a layman. The pending bill has the fatal flaw that it would make prima facie proof of copying too easy and would discourage a strongly held public policy which encourages competitors to redesign and improve an existing product.

Without a patent-type claim or some way of determining the scope of "substantially similar" and "substantial and material", counsel will have no way of forming an intelligent opinion on the question of copyright infringement, particularly in a case where the client has adapted a competitor's product; i.e. where there has been access and the second chip, being an adaptation, is similar. The courts have abandoned the attempt to establish rules for determining an infringement, so an adapting manufacturer must proceed at his peril, without any idea of what degree of appropriation from a prior design might subsequently be deemed by a lay jury to be too much.

The argument developed above, that all, or nearly all, of the features of an integrated circuit machine should be denied copyright protection under 17 USC 102(b) may not be welcomed by courts that are reluctant to grapple with the difficult question of whether some feature of an integrated circuit mask is or is not the only way to express an idea, but the Baker v. Selden - Morrissey line of cases indicates clearly that the defendant must be allowed to make his argument. The defendant will have to express the idea in words comprehensible to the trier of fact and then distinguish the idea he has used from whatever the plaintiff presents as alternate expressions of the idea.

The process, when applied repeatedly to the manifold features of an integrated circuit will certainly result in a very expensive trial.

An instructive example of the problems associated with applying copyright concepts to machines may be found in the series of cases brought by British Leyland Motor Cars against competitive corporations that were manufacturing replacement mufflers, without a license, to be used in British Leyland products.[23] Leyland had copyrighted the assembly drawings to the muffler plus tailpipe system and sued its unlicensed competitors for copyright infringement. Defendants offered as a defense the argument that the muffler itself was totally unlike the British Leyland muffler and the exhaust pipe was bent as it was in order to fit in the openings in the underside of the car.[24] This defense would be analogous to the situation described above in which competent integrated circuit designers faced with the same problem (making an exhaust pipe fit) would naturally produce a similar solution. If there was only one way to fit the pipe, then the idea of fitting the pipe in that particular way should not be protected (under U.S. law). The defense was brushed aside.[25] If and when the case reaches the merits, the trial court will presumably allow the defendant to make his argument, but the case cited above indicates that the British courts have yet to realize these Baker v. Selden issues exist. We may expect that a number of United States courts will not be willing to tackle these difficult issues, but will similarly brush aside any defense by the defendant that he made his design to satisfy the same constraints and thus necessarily arrived at a similar solution without any copying.

British manufacturers now seem to have available a new form of quasi patent protection - i.e., copyright protection for machines that lasts the life of the author plus fifty years; provides for an injunction routinely; and provides for no inventive standard to be met. The infringement test will apparently be that of copyright, i.e., what appears to be similar to a layman.

This catalog of features that benefit the copyright owner must be weighed against the drawbacks to the industry, to buyers of the industry's products and to society as a whole. The Sears and Compco cases serve to articulate the strong public policy in favor of the free use of ideas. Copyright protection for integrated circuit machines that extends beyond photographic copying contradicts that policy and would have a very strong inhibiting effect on progress.

It is useful to make a distinction between an exact (photographic) copy and a non-exact copy (in literary terms, a paraphrase). Prohibition of exact copying seems feasible and useful to the industry. Prohibition of improvement on the competition's products goes against public policy and offers great potential for mischief. What the industry needs is strong protection against photographic copying, coupled with limited permission for adaptation and improvement.

The industry also needs protection that can be enforced without attempting the nearly impossible task of educating a lay judge or jury into the arcane mysteries of integrated circuit design (known to only about a few hundred people in the country) well enough so that they can distinguish ideas from their expressions.

Since the purpose of machine copyright is to protect lead time, it is most important that a preliminary injunction be readily available, for that is the only relief that will be available soon enough to help the plaintiff. Protection that is practical to enforce will therefore require that the copying test of "substantial similarity" and the infringement threshold test of "substantial and material" be eliminated for both raise factual questions that will raise obstacles to a preliminary injunction.

VII. Machine Copyright

A modified form of copyright, referred to as "machine copyright" in order to distinguish it from conventional copyright, is suggested which is believed to afford a reasonable degree of protection for the innovator and also to protect the public interest in developing improved forms of machines.

Under machine copyright, 17 USC 102(b) would be modified so that ideas that are expressed in only one form (in particular, ideas connected with the layout of an integrated circuit) will receive protection, in contradiction to established copyright principles.

Machine copyright would abandon the test of "substantial similarity" to prove that copying took place and substitute for it the detection of traps, for exact copying, and the testimony of witnesses and the defendant's business records, for non-exact copying.

Machine copyright would also abandon the "substantial and material" test for infringement, and its corollary "fair use".

Injunctive relief would be confined to photographic copies. A defendant who had adapted plaintiff's design to form his own would pay only a modest amount for the labor he had appropriated.(26)

A. Elements

1. Procedure

A second copyright register would be maintained for protection of machines. The use of a second register is suggested in order to make as great a separation as possible between the two forms of copyright.

2. Conditions

The conditions for a machine copyright would be the same as for copyright: originality, but not novelty. No intellectual standard would be applied.

3. Remedy

The machine copyright owner would acquire a cause of action for damages against an infringer. Injunctions are meant to be confined to the case of photographic copying, as governed by equitable principles.(27)

4. Term

The term should be appropriate to protect lead time - say two years.

5. Author

The author need not be a human being.(28)

B. Enforcement of a Cause of Action

1. Elements

a. Proper registration by the plaintiff.

b. Manufacturing or selling in commercial quantities copied machines by the defendant. (Making or selling small numbers of copies would not be banned, so that reverse engineering would not be blocked).

2. Defenses

a. Invalid copyright; (e.g., not properly registered, expired, not a proper subject for machine copyright).

b. The design used the defendant's own work (even if it is indistinguishable from the copyrighted design).

c. The defendant copied or adapted the design from a source other than the plaintiff.

d. The plaintiff himself derived the design from another.

C. Remedy

1. Injunction

A preliminary injunction would be the ordinary remedy in the case of a photographic copy in which traps set by the plaintiff were found. An injunction after trial would ordinarily be worthless because the term of the copyright would be nearly over.

2. Measure of Damages

The measure of damage in the case of both a photographic copy and an adapted design is the value of the lead time to market saved by copying (or the labor saved). This is meant to be a different measure from copyright, which has overtones of free speech, expression, etc. where damages routinely include an accounting for the profits of the defendant. This measure of damages has the considerable advantage of flexibility. An exact copy of the whole chip will receive the maximum compensation, and copying a lesser amount will produce a lesser award.

D. Proof

1. Proof of Copying

It is suggested that the plaintiff's main method of proof of exact copying be proof of the copying of traps - nonfunctional, arbitrary features that the plaintiff has inserted in his design. At present, manufacturers of maps ordinarily insert deliberate errors in their maps as an aid to prove that copying has taken place. By analogy, designers of integrated circuits who wish to take advantage of copyright will deliberately introduce nonfunctional features, such as a transistor that is connected to nothing, the designer's initials, etc. and the copying of these will serve as overwhelming evidence that a copy was made. The traps will be reproduced in photographic copying, but not in the adaptation process.

In the case where no traps have been inserted into the design, the plaintiff may still point out detailed features of his design and attempt to use these features as proof that copying has taken place. The defendant may argue in all cases that the features relate to the functioning of the machine and that the resemblance arises from his engineers' satisfaction of the same constraints as plaintiff's engineers. If the copy is not exact, the defendant will in all probability have an easy time of this defense, because nearly every feature of a machine makes some difference. Even if the copy is exact, the difficulty and expense of proof should be enough to make the use of traps routine.

In any case, the plaintiff may use the testimony of the defendant's employees to establish that copying took place. In the case of integrated circuits, copying and design are done in teams so that there will ordinarily be several witnesses to acts of copying and to the lack of time spent in design. Although witness testimony is little used in literary copyright cases, the records of employee time spent, machine use, etc. should be helpful in establishing that the defendant has made a non-exact copy or adaptation. If a design which ordinarily takes several months to check was done in less than a week, the plaintiff will have a very strong case and the defendant will have a very hard time to explain it.

It is expected that exact copying will become as unusual in integrated circuits as it is in literature and for much the same reasons. Proof of copying using traps will be trivial and, since the defendant will have copied all of plaintiff's contribution, there will be no question of the degree of the taking. If the plaintiff can make a case that monetary damages are insufficient (he needs a period of exclusivity in order to build a customer base, say), in accordance with equitable principles, he may reasonably hope to be granted an injunction.

In the case of non-exact copying, which is expected to form the bulk of the cases, the defendant will have had to redo the layout and the checking process. This duplicate effort will delay his entry into the market by an amount that will often be comparable to the time required to design from scratch (e.g., he may get the product to market in one year instead of two). In that case, the plaintiff has already had a lead time that is substantial in the integrated circuit field. Since a preliminary injunction will not be possible when there are substantial factual questions as to whether copying has taken place; (questions that will take a great deal of expert testimony to resolve), the plaintiff must wait until after trial, at the earliest, in order to obtain an injunction. If the injunction cannot issue, as a practical matter, until after the term of protection has expired, then the only remedy will be monetary damages.

An important side effect of the use of traps to establish exact copying is that the second "substantial" concept of copyright - that of deciding whether the taking has been substantial enough to cause an infringement - will also become unnecessary. In copyright, once copying has been established, the next question for the trier of fact is whether the amount taken has been "substantial" and therefore that there has been an infringement, or if the amount taken was small and there has been no infringement. It has been argued above that this question will be very difficult for a lay jury. The result in literature has often been something of a threshold decision. If there has been a substantial taking, the defendant is ordinarily liable for heavy damages even if the amount taken is a small fraction of the defendant's work. If the amount taken is not substantial, then plaintiff gets nothing. With the measure of damages proposed being a sliding scale, the amount for which defendant is liable is the value of the lead time saved, which will in turn depend on the amount of time he has saved by doing the copying.

In a case of non-exact copying, the plaintiff must first establish that copying has taken place, based on whatever admissions he may extract from the defendant's employees and inferences that he may make from the defendant's business records. Once copying has been established, the defendant will be liable for damages, based on the value of the lead time to market that he has saved. Consider several examples:

1) Defendant has photographically copied the memory cells of a memory chip, but the particular cells are standard in the trade and the layout is nearly all done by machine. Only a short time will have been saved and damages will be small, perhaps de minimus.

2) Defendant has further made only minor modifications to the plaintiff's substantially improved control circuitry for the same memory chip. In particular, the defendant has copied exactly the plaintiff's placement of logical circuits on the chip and the interconnections between them. It took plaintiff X months to design the layout and Y months to check it. Defendant saved Z months by copying. Plaintiff should be awarded the value of Z months of lead time.

3) Defendant reverse-engineered plaintiff's memory chip to discover the schematic, then redid the layout of the (conventional) memory cells in order to use a different process that saves space. Defendant took as long to lay out the memory as plaintiff. There should be no award for the plaintiff because no time was saved.

4) Defendant further used plaintiff's schematic for the control circuitry, but did the layout over because his different process resulted in different sizes for the

logical units. He saved the X months it took to design the overhead circuits, but spent the same amount of time on the layout. Plaintiff should be awarded the value of the X months of design that were saved.

In these examples, the question of whether defendant passed some threshold of "fair use" was not raised. The "fair use" concept arises from the "substantial and material" test for infringement which is not found in machine copyright. All copying, no matter how small, may give rise to liability under machine copyright. Plaintiffs are not likely to press a suit after defendants have shown them evidence that will limit the recovery to an amount that will not justify the cost of litigation. The determination of the value of lead time saved, while difficult, is surely less difficult than the determination of whether an adaptation of another's machine is a taking in a reasonable amount (that is encouraged by the courts) or is more than a reasonable amount.

E. Inhuman Authors

There are now in commercial use computer programs that will select the location on an integrated-circuit chip of logical blocks of a system and lay out the connections between the logical blocks and the pins.(29) Other programs will accept as input the time constraints on a logical circuit (reponse time, rise time, etc.) and the amount of current that it must supply and, from that input, determine the sizes of the transistors and capacitors in the circuit. These and other programs are being improved at a rapid rate, so that it is now, or soon will be, possible to say that the "artist" or "author" who created an integrated circuit mask was a computer program!

This circumstance has been given special prominence because few things point up so strongly the difference between copyright and machine copyright. What copyright lawyer, educated in the literary culture and trained to protect literary works, could tell a judge with a straight face that he is attempting to protect the creativity of a computer program?

There will be a human logic designer, or systems designer, in the background who has specified the function the system is to perform and the constraints (size, speed, power consumption, input data, etc.) on the system, but the various functions that go into the layout process (specifying the physical size of the separate transistors, capacitors, fitting them together as closely as possible, connecting them without interference) will have been untouched by human hands or minds.

It seems intuitively obvious to the author that the idea/expression distinction that is fundamental to copyright ceases to have any meaning in such a case. If the integrated circuit mask has been laid out strictly according to fixed rules to implement a schematic that has itself been determined by a computer program from the logical functions that are specified by the system designer (and the logical functions are at a higher level of abstraction than the schematic) it makes no apparent sense to say that the computer program has made an "expression" because it is simply following the instructions built into it. Further, it makes no sense to say that the system designer (the last human to have an effect on the layout) has expressed himself through the computer program because he cannot control the computer to vary the details of the layout to suit his taste or personality.

Copyright has always assumed that the author was a human, of course, so there are no relevant cases. Nonhuman authors could be dealt with by assuming the problem away -- i.e., by assuming that the system designer has chosen the size, shape, etc. of the components although in fact he has not. The problem could also be dealt with by the courts' ruling that a computer-designed layout may not be copyrighted.

In machine copyright, the point is to protect the lead time of a product and the idea/expression distinction has already been eliminated in order to avoid the problem of litigating whether this or that feature of a machine is the only way to express some idea. Accordingly, there is no problem in explicitly instructing the courts that "authorship" is irrelevant, except as to questions of originality. If a feature was copied elsewhere, it may not be protected by machine copyright; i.e., there must be "originality", even if it is mechanical.

Summary

It has been argued in this article that:

a) Conventional copyright principles will not protect most of an integrated circuit mask because of the effect of 17 USC 102(b). In particular, the most important features of the circuit will have been carefully thought out, or designed and thus there would likely be no other way to express the ideas that are represented by those features.

b) The standard test of substantial similarity to determine copying does not work because one cannot infer copying from similarity when a machine is designed under constraints. There is the further difficulty that the trier of fact must become literate in design language, as he is literate in English, in order to decide if there has been copying.

c) The threshold test for infringement has the same difficulty: one cannot make an intelligent decision as to whether there has been a "substantial and material" appropriation if one doesn't speak the language.

Assuming that lead time in the integrated circuit industry ought (as a matter of public policy) to be protected, a modified form of copyright protection is suggested, having the following main points:

a) 17 USC 102(b) (Baker v. Selden) is modified by exempting machines from its scope.

b) the test of similarity is not allowed. Proof will be by the copying of traps or witness' testimony.

c) There is no threshold for infringement. Damages are proportional to the time saved, so that potential plaintiffs will be limited by the prospect of the recovery being less than the cost of litigation.

Machine copyright has the advantage that there will be protection for design work - protection that can be implemented quickly and at a reasonable cost. Exact copying will be effectively suppressed. Adaptation and improvement will be permitted, but at a cost that reflects what has been taken from the plaintiff. The trier of fact has to deal with questions including business records that support a design effort and testimony as to whether the defendant used the plaintiff's work. As much as possible, the trier of fact is able to avoid what may be compared to deciding literary questions in a foreign language.

Footnotes

1) HR 7207 was introduced in September, 1982 and reintroduced in January, 1983 as HR 1028. A similar bill was introduced in 1979, but was withdrawn when the industry could not agree to support it. Integrated circuits are formed by depositing layers of impurities on a silicon substrate in patterns that are defined by projecting a pattern of light onto a photosensitive chemical. The light pattern is determined by a mask. The series of masks used to form an integrated circuit determines the sizes and shapes of the various components of the circuit elements and their interconnections.

2) Computers are referred to in the trade as machines even when in the form of integrated circuits. Most integrated circuits are components of machines. The term "machine" was selected for its connotations, in order to alert the reader to the difference between literature and the subject which the pending bill proposes to protect.

3) Kellogg Company v. National Biscuit Company, (1938) 305 US 111, 39 USPQ 296.

4) Compco Corp. v. Day-Brite Lighting, Inc. 140 USPQ 528.

5) Since the problem perceived by the industry is the erosion of an innovator's lead time, any protective scheme must be usable as soon as a rival introduces his product. If an examination system, in which the design is measured by some standard, is used, the process will take too long. Only a registration system will be fast enough.

6) The Patent Bar has been trained to compare a possibly infringing product with the poorly-defined boundary of a patent claim, the boundary being defined by what those skilled in the art would consider to be equivalent to the particular thing the inventor has described. Since a registration system would not produce a carefully crafted patent claim, the bar would have to devise a method of deciding what does and does not infringe.

7) In Compco, above, the Supreme Court applied the doctrine of preemption to overrule state anti-copying laws that were deemed to conflict with the patent or copyright laws. Since an FTC determination is Federal law, it is not affected by Sears or Compco. A severe practical problem is that a private cause of action against the copier is essential to protect lead time. Even if the FTC were persuaded, Congress would have to amend the Federal Trade Commission Act to grant the private right that it has previously withheld.

8) In the data processing field, computers (which are implemented in integrated circuits) are referred to as machines and integrated circuits fall within the definition of the word in The American Heritage Dictionary (Houghton Mifflin).

9) The standard treatise on Copyright is Nimmer on Copyright, by Melville B. Nimmer, published by Matthew Bender, N.Y. N.Y. For the general reader, a useful introduction is the chapter in Corpus Juris Secundum, Volume 18.

10) The lead case for the proposition that the "idea" is not protected, but only its expression and thus for the corollary that, if the idea has only one expression, that expression may not be protected by copyright, is Baker v. Selden, 101 US99, 25 L.E.d 841 (1879). See also Morrissey v. Procter & Gamble Company 379 F2d, 675 (1967) and Herbert Rosenthal Jewelry Corp. v. Kalpakian, 446 F2d 738 (1977) which develop the corollary: if there is only one (or only a few) way to express the idea, then copyright protection for that expression would effectively protect the idea and such protection is forbidden under Baker v. Selden. The subject of Baker was a blank account book, ruled to make bookkeeping easier. The subject of Morrissey was a set of rules for a contest and the subject of Rosenthal was a jeweled pin in the form of a bee.

This basic principle has been incorporated in 102(b), but the extent to which the corollary will be followed is not clear, since the fact pattern of a single possible expression has rarely arisen under copyright and the law of the corollary is not well developed. Professor Nimmer expresses rather strongly (paragraph 2.18) his doubt that the underlying idea can be monopolized. His examples are taken from the arts, of course, where the subject is not constrained by functional requirements.

11) See Nimmer supra, Chapter 13.

12) To elaborate slightly, the test rests on the premise that similarity implies a paraphrase (disguised copying). If the idea forced or strongly influenced the choice of words, then the use of the idea (explicitly permitted) would result in the same or similar words and similarity would imply only the use of the idea. It could not imply copying.

13) Nichols v. Universal Pictures Corporation, 45 F2d 119, 121 (2nd Cir. 1930).

14) Nimmer, Chapter 13
Arnstein v. Porter, 145 F2d 464 (2d Cir. 1946).

15) See footnote 10 above.

16) 17 USC 101, last paragraph.

17) Integrated circuits are formed from layers of silicon and insulators of various compositions that combine to form the transistors, capacitors and other components that make up the circuit. The configuration of the various layers is determined by directing a pattern of light onto a photosensitive surface. The pattern is determined by the mask and a set of masks, together with the specifications of the processing steps (composition, temperature, time, etc.) specify the details of the circuit. The next level of abstraction is the schematic diagram, in which conventional symbols represent the circuit components. The schematic does not indicate the size, shape, or geometric relationship of the components, and a schematic may be translated into many different sets of masks that are functionally equivalent.

18) Morrissey v. Procter & Gamble
379 F2d 675 (1967)
"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. In such circumstances it does not seem accurate to say that the subject matter would be appropriated by permitting the copyrighting of its expression. We cannot recognize copyright as a game of chess in which the public can be checkmated. CF. Baker v. Selden, supra....Rather in these circumstances, we hold that copyright does not extend to the subject matter at all, and plaintiff cannot complain even if his particular expression was deliberately adopted."

19) The reader will already have asked the question: What of the many machines that are not well designed, in which there are features that are standard items in the trade? Many machines do indeed have features that were taken from general knowledge in the trade and were not designed by the "author"; but they were designed by someone. The fact that the author copied them does not affect the 102(b) argument.

It is not necessary to this argument that all features of a machine be denied protection by 102(b). In fact, there will almost always be components that are "original" with the draftsman and were not "designed" - i.e., it simply does not make any difference to the operation or cost of the circuit which of many possible features is used. These components may properly be protected under conventional copyright principles, _if_ these features that do not make any difference to the operation/cost/etc. of the machine are "substantial and material".

The point being made is that the idea/expression distinction does not work for integrated-circuit machines because: a) many or most of the elements of the machine will be denied protection under 102(b) and the _Baker v. Selden_ - _Morrissey_ line of cases; and
b) litigating the question of whether the many thousands of particular circuit elements are protected or not will be so time consuming and costly that a fair result will occur only by chance.

20) Assuming that there is some portion of the chip that is protectable under 102(b) and that is large enough to avoid a de minimus dismissal, there remains the interesting policy question of whether those portions of the chip that are immaterial to its operation or arbitrary in nature ought to be given protection at all, let alone be protected by the stringent remedies associated with copyright.

21) "Laying out" is the process of fitting the different circuit elements and their interconnections together. The arrangement is referred to as the layout.

22) 17 USC 101.

23) British Leyland v. T. I. Silencers, English High Court (Chancery Division) 1980 Common Market Law Reports 1 July, 1980, 332. The particular case cited was an interlocutory appeal on points related to Articles 36(1) and 36(2) of the Treaty of Rome.

24) The opinion quotes (p. 334) the defendants: " --such infringement arises only by reason of similarities in such features as the dimensions and configurations of bends in tubes of standard gauge and the location of silencer boxes within such configurations. These features are dictated by spatial constraints of the vehicle involved and involve no high degree of technology or skill in design and represent a small part of the intrinsic value of any exhaust assembly." They further pointed out that most of the value was in the muffler, which was not at all like British Leyland's muffler.

25) Mr. Justice Walton stated: "--there is no doubt at all that under English law, if the plaintiffs are entitled to the rights they claim, they cannot be deprived of them on any such reasoning as that which I have just read."

26) It might be argued by people with tidy minds, that such protection ought not to be in "copyright" at all, but rather in unfair competition. It has been argued above that placing lead time protection within the framework of copyright does not work because of the fundamental difference between literature and engineering. The theory of competition would be more coherent if copying one's competitor's product too soon were classed as another form of unfair competition; but "The life of the Law is not logic but

common sense" in the words of Justice Holmes and the practical difficulties of changing unfair competition law in the light of Sears and Compco are considerable.

27) Where lead time (about 2 years) is to be protected, the only injunctive relief that is significant is a preliminary injunction. The lead time period will be over before the case comes to trial, in most jurisdictions, so a permanent injunction is of no use. If the copying is not exact, there will be many difficult factual questions and a preliminary injunction will be out of the question.

In copyright, where there are overtones carried over from free speech and the long-assumed right of an author to control his speech, injunctions are issued with a freedom that is surprising to the commercial world, where we are only talking about money and monetary damages are ordinarily sufficient. One situation where an injunction is reasonable is the case where the plaintiff is entering a market with a highly novel product. If his established competitors copy the product, we can never know what his market share would have been. Other situations should result in monetary damages.

28) This startling feature is treated separately in a section of its own. It reflects current practice, not something anticipated in the future.

29) Electronics Feb. 10, 1983 pages 134-145.

AMERICAN PATENT LAW ASSOCIATION,
Arlington, Va., March 6, 1984.

Re H.R. 1028.

Hon. ROBERT W. KASTENMEIER,
Chairman, Subcommittee on Courts, Civil Liberties, and the Administration of Justice, House of Representatives, Rayburn House Office Building, Washington, D.C.

DEAR MR. CHAIRMAN: The American Intellectual Property Law Association (formerly the American Patent Law Association) is a national society of lawyers engaged in the practice of patent, trademark, copyright, licensing and related fields of law relating to intellectual property rights. The Association has been considering H.R. 1028, the "Semiconductor Chip Protection Act of 1983," since its introduction early in the 98th Congress.

The Board of Directors of the Association has adopted the following Resolution which is relevant to the issue addressed by the bill:

"Resolved, the American Intellectual Property Law Association endorses the principle of providing statutory registration-type protection for semiconductor and like chip mask patterns."

As this Resolution implies, the Association does not support the enactment of H.R. 1028. We do understand that the Subcommittee you chair is actively considering revisions of H.R. 1028 or alternative methods of providing the effective protection this industry needs. If so, we strongly support those efforts. We recognize that this is a difficult and complicated legal problem. If we can assist you in any way, we would be pleased to do so.

Sincerely,

B. R. PRAVEL, President.

Enclosure.

SURVEY OF OPINION ON H.R. 1028 A BILL TO AMEND THE COPYRIGHT ACT TO PROVIDE FOR COPYRIGHT PROTECTION OF SEMICONDUCTOR CHIPS AND MASKS WORKS

The proposed legislation embodied in H.R. 1028/S. 1201 is intended to amend the copyright law, Title 17, of the U.S. Code to protect semiconductor chips and masks against unauthorized duplication. In previous debates there has been substantial agreement that some form of protection should be enacted, but substantial disagreement whether the copyright law is the proper means for providing protection.

Under the proposed legislation, section 106 would be amended to provide certain exclusive rights in the case of mask works, a "mask work" being "a series of related images having the predetermined, three dimensional pattern of metallic, insulating, or semiconductor material present or removed from the layers of the semiconductor chip product." The exclusive rights would extend to the manufacture of a semiconductor chip using the images of the mask work and to the distribution or use of a semiconductor chip made with the mask works. Under certain circumstances compulsory licensing with respect to mask works is required. The duration of the copyright in mask works would endure for only ten years from the first authorized distribution, use in a commercial product, or manufacture in commercial quantities of the semiconductor chip. Also, it is provided that a purchaser of a semiconductor chip, who purchased it in good faith without having notice of infringement, would not be liable as an infringer.

ARGUMENTS ADVANCED IN SUPPORT OF THE LEGISLATION

The supporters of this legislation have urged that the legislation is needed, is appropriate, and should be enacted because:

1. The "mask works" as defined in the proposed legislation fall within the words "writings . . . of an author" as expressed in the U.S. Constitution, Article I, Section 8, cl. 8, which have been interpreted by the Supreme Court "to include any physical rendering of the fruits of creative, intellectual or aesthetic label." *Goldstein* v. *California*, 412 U.S. 546, 561 (1973). Even if "mask works" are not regulatable under Article I, Section 8, cl. 8, they are subject to federal control pursuant to the Commerce Clause of the Constitution.

2. Masks qualify as "original works of authorship" under Section 102(a) of the current Copyright Act. Extension of copyright protection to "mask works" is consistent with the philosophy of the existing Copyright Act.

3. A special statutory class is needed in section 106 for "mask works" because of the restrictive definition of "pictorial, graphic, and sculptural works" in section 101 of the Copyright Act. "Mask works" being somewhat unique require special defini-

tion as is set forth in the proposed legislation so that copyright protection can be tailored to the needs of such works.

4. The compulsory licensing of mask works, as provided for in the legislation, reflects the judgment that "mask works" are different from other copyright works and require greater accessibility by the public.

5. The period of protection of ten years is proper, again recognizing the special character of "mask works" and the realities of development in the semiconductor industry.

6. The provision protecting innocent purchasers of semiconductor chips containing infringements of mask works is desirable to protect those who use such chips innocently and who may have invested substantial sums in the course of doing so.

7. The present bill does not in any way undermine the basic concept that copyright protection extends only to the expression of an idea. The copyright protection called for by this legislation would only extend to the particular "expression" embodied in the individual masks—i.e., the configuration of lines on the mask.

8. Although an entirely new form of protection for "mask works" could conceivably be neacted into law, it is not a practical solution to the problem. Semiconductor chips need protection now, and the additional delay necessary to enact a new form of protection now, and the additional delay necessary to enact a new form of protection would be unacceptable. The administrative burden imposed on the government by a separate system of protection would be excessive and unnecessary. Furthermore, a separate statute could only create rights in mask works that would be similar to copyright in character, making the new statute redundant.

ARGUMENTS ADVANCED IN OPPOSITION TO THE LEGISLATION

The following arguments have been expresed by those who oppose the legislation:

1. A semiconductor chip product is not "a writing" within Article I, Section 8, cl. 8. Using Title 17 (Copyright) as a vehicle for protecting utilitarian items (chips) violates the Constitution.

2. This legislation also defines a chip mask pattern as "a discovery," which raises a conflict with 17 U.S.C. § 102(b) denying copyright protection to any". . . system, method of operation . . . or discovery."

3. If a chip is indeed a "discovery" and protected by copyright law, the entire question of preemption of trade secret law by copyright vis-a-vis 17 U.S.C. § 301 is further complicated.

4. A question is raised whether a third party by "reverse engineering" the chip may infringe the copyright if the third party uses only what the chip discloses as to unpatented methods, systems, or ideas embodied in the chip which are traditionally not protected by copyright.

5. New basic rights are created by the bill including the exclusive right to "use" a mask to make a chip and to "use" the chip itself. Such a "use" right is a new concept under the copyright law and further obfuscates the section 301 preemption issue.

6. The legislation would add a new right "substantially to reproduce" (images of a mask work). The new right "substantially to reproduce" would be in addition to, and not in lieu of, the existing right under 17 U.S.C. § 106(1) "to reproduce." This is confusing.

7. The basic rights provided in this bill overlap or are analogous to patent rights to make, use and sell and are not those rights traditionally associated with copyright.

8. The bill selectively permits the term "copy" to apply to semiconductor chips only under a limited number of sections of the Copyright Act. Previously the Copyright Act provided for only two categories of tangible fixations of works: copies and phonorecords. However, the selected use of "copy" as it applies to chips will add confusion in this area of the law.

9. Since computer programs and data bases often are embodied in chips, the proposed legislation may inadvertently include these copyrighted works in its compulsory licensing provision.

10. The copyright term for copyright of mask works would be computed differently from any other works under the Copyright Act and have a different duration. This basic change may introduce unforseen problems.

11. The bill is based, in part, on the Commerce Clause of the Constitution while the remainder of the copyright law is based on the "authors and inventors" Clause, and creates confusion as to the constitutional basis for semiconductor mask work protection.

The above lists represent some of the positions being taken by the supporters and opponents of this legislation.

NICOLET,
November 2, 1983.

Hon. ROBERT W. KASTENMEIER,
House of Representatives, Rayburn House Office Bldg., Washington, D.C.

DEAR REPRESENTATIVE KASTENMEIER: Nicolet Instrument Corporation strongly supports the rapid passage of H.R. 1028, the Semiconductor Chip Protection Act of 1983. We urge you to support this bill

The electronics industry is a vital contributor to Wisconsin's economy; Nicolet alone employs approximately 600 individuals. The industry's importance to Wisconsin's future economy is unquestioned. For the electronics industry to remain competitive, it is imperative that semiconductor designers have legal protections from pirate firms that copy their designs. H.R. 1028 gives semiconductor designers the protections necessary to continue the innovative progress that has contributed to the success of our industry.

Passage of H.R. 1028 is particularly important at a time when new generations of semiconductor products will soon enter the market. Semiconductors must have legal protections as soon as possible if America is to keep its edge in the electronics field.

Sincerely,

PATRICK D. LYNCH,
Vice President, Planning and Development.

HARCOURT BRACE JOVANOVICH, INC.,
Washington, D.C., August 17, 1983.

Representative ROBERT KASTENMEIER,
Chairman, Subcommittee on Courts, Civil Liberties and the Administration of Justice, House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: The Proprietary Rights Committee of the Information Industry Association is pleased to have the opportunity to provide comments with respect to the "Semiconductor Chip Protection Act of 1983".

The IIA is a trade association comprised of nearly 200 companies, with annual revenues in the range of $5 billion dollars, and non-profit professional and educational organizations. These companies and organizations are the entrepreneurs of the information age. Our members are in the business of collecting, organizing, abstracting, indexing, distributing, and otherwise adding value to information. We are vitally concerned with the economics and the public policy that affect information content in the marketplace. A list of our members is attached for your reference.

Earlier this year, the IIA Proprietary Rights Committee studied the provisions of H.R. 1028, and counsel to the Committee prepared the attached memorandum, dated April 18, 1983, which substantially reflects the views of the Committee on this bill. We would like to furnish copies of this memorandum to the Subcommittee and respectfully request that these comments be included in the record of the hearing held by the Subcommittee on August 3.

Sincerely yours,

MARSHA S. CAROW,
Chair, Proprietary Rights Committee.

SCHWAB, GOLDBERG, PRICE & DANNAY,
April 18, 1983.

The bill seeks to amend the Copyright Act to provide for semiconductor chips the protection which such important contributions to high technology deserve and which they require if the necessary incentive for their development is to be maintained and enhanced.

The bill seeks to provide this protection while avoiding the imposition of catastrophic liability on those who have unknowingly purchased infringing chips and invested substantial sums in, for example, the manufacture or operation of complex computers or other expensive equipment designed around such chips.

Such protection is needed, and such safeguards are needed. However, it is not clear that H.R. 1028 is the appropriate vehicle to satisfy either of these needs.

1. The specific wording of various provisions in the bill can profitably be scrutinized for possible drafting improvements. However, it is more appropriate to focus on basic and broader questions which are raised by the bill. Among these is the question whether an amendment to the Copyright Act is the appropriate legislative approach to achieve the bill's goals; or whether it would be more appropriate to consider the drafting and enactment of a sui generis statute.

2. Since neither the patent nor copyright statutes can provide the much needed protection without substantial alteration, or perhaps distortion, of their basic structure, a sui generis statute should perhaps be enacted. An analogy would be the proposal for protecting ornamental designs. (H.R. 2985, 98th Cong.) Chips per se are functional and would not come under that proposal, but it illustrates an approach to sui generis protection for works requiring it.

3. Saying that a semiconductor chip product is (alternatively) "a writing" (bill, § 2, p. 2, line 8) doesn't necessarily make it so; and there is substantial doubt the Constitution and case law would so interpret the phrase.

4. Also, saying that a chip is (alternatively) "a discovery" (loc. cit.) doesn't necessarily make it so. However, if it is, it may be barred from protection by reason of the present 17 U.S.C. § 102(b). That provision, by denying copyright protection to any ". . . system, method of operation . . . or discovery," etc., implements the fundamental idea/expression dichotomy which permeates the copyright law. A "discovery," of course, can be patentable subject matter under the Constitution and Title 35.

5. On the other hand, it is conceivable that the bill's categorization of a chip as a protectible "discovery" (bill, § 2, p. 2, line 8) might have the effect of providing copyright protection for a "discovery" by overriding *sub silentio* the prohibition under 17 U.S.C. § 102(b) against copyright protection for such a "discovery." The bill's effect, if any, on § 102(b) of the Act is not clear but is most important.

6. If the proposed legislation were to be so interpreted, a misappropriator of any trade secret in the chip "discovery" might be able to argue preemption more effectively than is now possible. Although most, but by no means all, authorities have expressed the view that § 301 (the preemption section) of the present Copyright Act does not preempt trade secret protection, the bill might thus raise basic, and complex, questions in the relationship of the proposed statutory amendment to trade secret law.

7. One argument presumably to be made by such a misappropriator would be that trade secret rights would be "equivalent" under 17 U.S.C. § 301 to one or more of those copyright rights which under the bill might now be afforded a "discovery," and that a "discovery" would be copyrightable subject matter under the Act as amended.

8. Even more important in the context of the preemption question is the fact that among the new categories of copyright rights which the bill would enact would be rights such as exclusive rights to "use" a mask to make a chip and to "use" the chip itself (bill, § 4(3), p. 4, lines 1-2, 8-10). A "use" right is not presently a right which the Copyright Act provides under 17 U.S.C. § 106 for any other category of work.

9. It is not clear whether the copyright, or quasi-copyright, protection under the bill would make it an infringement for a third party to reverse engineer the chip, even if the third party "uses" only what the chip discloses as to unpatented methods, procedures, systems, ideas, etc. (traditionally all unprotected under copyright) embodied in the chip and does not "use" from the chip embodiment any expression which is traditionally protected under copyright.

10. The bill presumably would not make independent creation of a mask or chip an infringement. However, it should be noted that any "discovery" (bill, § 2, p. 2, line 8), ideas, etc. which are protected against "use" would be given such protection without having to meet any novelty requirement.

11. In addition to enacting an "exclusive right . . . to use," the bill would add basic concepts and terminology heretofore unknown to the Copyright Act—such as a right "to embody" (a mask work in a mask) (bill, § 4, p. 3, line 23) and a right "substantially to reproduce" (images of a mask work) (bill, § 4, p. 4, line 4). The new right "substantially to reproduce" would be in addition to, and not in lieu of, the existing right under 17 U.S.C. § 106(1) "to reproduce."

12. The substance of the basic rights which the bill would provide to chip proprietors would be those largely analogous to the patent rights to make, use and sell, not the traditional copyright rights (bill, § 4, p. 3, line 22 to p. 4, line 10).

13. The bill would provide also a third alternative Constitutional basis for protection of chips: i.e., if their manufacture, use or distribution "is in or affects commerce" (bill, § 2, p. 2, lines 9-10). However, such a provision is found nowhere else in the Copyright Act. If the bill were enacted we would have the anomaly of an

entire Title of the United States Code relying for its Constitutional authority (and its theory and interpretation) on Article I, Sec. 8, Cl. 8., with the sole confusing exception of a single category of works which—perhaps—relies upon the Commerce Clause.

14. The bill (§ 2, p. 3, lines 3-6) selectively permits the term "copy" to apply to chips under only a limited number of sections of the Copyright Act (and presumably no others) where that term now appears. Such legislation would add a gray third category to what is otherwise a reasonably clear division of tangible fixations of works into only two categories throughout the Act: "copies" and "phonorecords."

15. In order to provide the protection essential for innocent infringers who may have invested in their own products far more than the cost of the infringing chip unknowingly used in their products, the bill would enact a complex compulsory license (bill, § 5, p. 4, line 12 to p. 6, line 9). The recent history of domestic and international erosion of rights of authors, inventors and trademark owners suggests that the incursion of compulsory licenses into intellectual and industrial property statutes should be avoided if at all possible.

16. Moreover, the bill may inadvertently sweep into the scope of its provisions limiting copyright protection (e.g., compulsory licensing, limited duration of copyright, and other provisions) other copyrighted works which may reside on the chip or be generated thereby, e.g., computer programs and data bases.

17. The duration of copyright for "mask works" (bill, § 6, p. 6, lines 10-20) would be a ten-year period, thus setting such works apart as the only category of works under the entire statute for which a separate term of protection would exist.

18. The copyright term under the bill would be computed differently from that of all other works under the Copyright Act. The term would not be computed on the basis of any of the existing general criteria, such as the individual author's life-plus-50 years or, for corporate authors, the earliest of 75 years from publication or 100 years from creation. Rather it would be computed from the "first authorized . . . distribution," "first authorized . . . manufacture in commercial quantities" (bill, § 6, p. 6, lines 15-18). The concepts underlying the latter two of these three events appear not to have been employed by the copyright law previously.

As indicated at the outset of this memorandum, the specific wording of the bill can be reviewed in detail for possible modification of the language. It is suggested however that it may be more fruitful to review first some of the broader questions such as those above.

Legislation is much needed in this area. The threshhold question is whether the needed legislation should take the approach of H.R. 1028 or an alternative approach.

MORTON DAVID GOLDBERG.

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INFORMATION INDUSTRY ASSOCIATION,
Washington, D.C., April 30, 1984.

Hon. ROBERT W. KASTENMEIER,
Chairman, Subcommittee on Courts, Civil Liberties, and the Administration of Justice, Committee on the Judiciary, House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: The Information Industry Association wishes to provide brief comments on the proposed substitute amendment to the "Semiconductor Chip Protection Act of 1983," H.R. 1028, as marked up on April 11, 1984.

The IIA is a trade association representing 300 information companies as well as a number of non-profit professional and educational organizations. These companies and organizations are the entrepreneurs of the information age. Our members are in the business of collecting, organizing, abstracting, indexing, distributing, and otherwise adding value to information. We are vitally concerned with the public policy that affects information content in the marketplace. A list of our members is attached for your preference.

The proposed substitute amendment would provide an appropriate means of protection for semiconductor chips. It is our view that contributions as important to high technology as semiconductor chips deserve and require protection if the necessary incentive for their development is to be maintained and enhanced.

At this time we wish to make two critical points about the amended bill:

1. The legislation should make clear that protection under chapter 9 does not in any way affect or detract from existing copyright protection for other works (e.g., computer programs and databases) which may be embodied in the same chips which embody the "mask works."

2. More generally, the provisions which would implement the sui generis protection under chapter 9 should not—either by what they say or by what they do not say—invite an interpretation that Congress intends by implication to change the meaning of the provisions of chapters 1-8 or the meaning of the specific terms used in those earlier chapters. Indeed, the overall relationship between chapters 1-8 and chapter 9 should be clarified, so as to avoid unnecessary confusion.

The concerns we mention are addressed in part by Section 912 (a) and (b) of the proposed amendment. However, we believe that the Congressional intent underlying those provisions should be expressed more fully, both in an expansion of the language of the bill and in supporting language in the legislative history.

We would be pleased to provide any further comments or assistance you may desire in order to implement legislation which is greatly needed for our technology and our economy.

Sincerely,

ROBERT S. WILLARD,
Vice President, Government Relations.

Enclosure.

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NATIONAL SEMICONDUCTOR,
August 19, 1983.

Hon. ROBERT KASTENMEIER,
Chairman, Subcommittee on Courts, Civil Liberties and Administration of Justice, Rayburn House Office Building, Washington, D.C.

DEAR CONGRESSMAN KASTENMEIER: National Semiconductor Corporation wishes to place the following statement on record in regard to the proposed Semiconductor Chip Protection Act of 1983.

National Semiconductor Corporation supports the proposed Act as set forth in the document of February 24, 1983, before the House of Representatives (copy enclosed), subject to the following provisos:

1. National agrees with the widely held position that legitimate reverse engineering is not to be prohibited. In furtherance thereof, we submit that specific language making this clear should be included in the proposed Act.
2. The proposed Act should also include language setting forth a simple and rapid procedure for establishing that legitimate reverse engineering has been undertaken. This would allow the parties to avoid drawn-out legal proceedings involving large amounts of time and expense. No injunction could issue to the copyright holder during a reasonable period of time given to allow proof of legitimate reverse engineering, in accordance with that procedure.
3. The effective date of the Act should remain ninety days after enactment of the Act.
4. With reference to Sec. 9(2) of the proposed Act, in the case of masks made in or imported into the United States before the effective date of the Act, replacement of such masks should be allowed.

While National supports the proposed Act in accordance with the above, there is some concern as to whether such an Act, if passed, would provide a value in protection that is worth the burden placed on parties in documenting legitimate reverse engineering.

Yours very truly,

JOHN R. FINCH,
Vice President and General Manager, Semiconductor Division.

NATIONAL ASSOCIATION OF MANUFACTURERS,
April 26, 1984.

Hon. PETER W. RODINO,
Chairman, House Committee on the Judiciary,
House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: We note the recent reporting of the Semiconductor Chip Protection Act, H.R. 1028 as amended by the Subcommittee on Courts, Civil Liberties and the Administration of Justice. The swift action by the Subcommittee is an encouraging indication that this legislation can be enacted in this session of Congress.

NAM believes that this addition to U.S. intellectual property law, although unusual in terms of traditional concepts of what is copyrightable, will provide U.S. semiconductor companies with much-needed protection against unauthorized copying of semiconductor designs and masks (glass plates that incorporate circuit patterns).

Mr. Ralph Thomas, Senior Vice President, American Electronics Association, recently noted that this legislation "will enable U.S. semiconductor manufacturers to remain competitive in an increasingly combative world marketplace. [The legislative] provides incentives for these firms to invest in vital research and deveopment programs and eliminate the unfair advantage presently available to those who would pirate and subsequently copy semiconductor designs."

We agree, the threat of pirating of semiconductor chip designs is a deterrant to innovation in semiconductor products. We believe that this legislation can help U.S. manufacturers maintain our technological edge.

Sincerely,

RICHARD SEIBERT.

APPENDIX 2.—ADDITIONAL MATERIALS SUBMITTED BY WITNESSES

A. (By Hon. Don Edwards)

Electronic Mini-Marvel That Is Changing Your Life—The Chip

(By Allen A. Boraiko)

It seems trifling, barely the size of a newborn's thumbnail and little thicker. The puff of air that extinguishes a candle would send it flying. In bright light it shimmers, but only with the fleeting iridescence of a soap bubble. It has a backbone of silicon, an ingredient of common beach sand, yet is less durable than a fragile glass sea sponge, largely made of the same material.

Still, less tangible things have given their names to an age, and the silver-gray fleck of silicon called the chip has ample power to create a new one. At its simplest the chip is electronic circuitry: Patterned in and on its silicon base are minuscule switches, joined by "wires" etched from equisitely thin films of metal. Under a microscope the chip's intricate terrain often looks uncannily like the streets, plazas, and buildings of a great metropolis, viewed from miles up.

Even more incongruous, a silicon flake a quarter inch on a side can hold a million electonic components, ten times more than 30-ton ENIAC, the world's first electronic digital computer. ENIAC was dedicated in 1946, the ancestor of today's computers that calculate and store information, using memory and logic chips. But ENIAC's most spectacular successor is the microprocessor—a "computer on a chip." This prodigy is 30,000 times as cheap as ENIAC, draws the power of a night-light instead of a hundred lighthouses, and in some versions performs a million calculations a second, 200 times as many as ENIAC ever could.

The chip would be extraordinary enough if it were only low-cost, compact electronics, but its ability to embody logic and memory also gives it the essence of human intellect. So, like the mind, the chip has virtually infinite application—and much the same potential to alter life fundamentally.

A microprocessor, for example, can endow a machine with decision-making ability, memory for instructions, and self-adjusting controls. In cash registers the miniature computer on a chip totals bills, posts sales, and updates inventories. In pacemakers it times heartbeats. It sets thermostats, tunes radios, pumps gas, controls car engines. Robots rely on it; so do scientific instruments such as gene synthesizers. Rather than simply slave harder than humans, machines can now work nearly as flexibly and intelligently, to begin priming a surge in productivity we may one day recall as the second industrial revolution.

The chip's condensed brainpower nourishes another phenomenon—personal computers. Last year more than 800,000 were sold, most to people who do not know how these first cousins of the pocket calculator work, nor need to know, because the chip makes them increasingly easy to use.

Piggybacking on personal computers are dozens of new services. Exotic now, computer conveniences such as electronic mail and newspapers and home banking and shopping could in time become as universal as telephone service.

Questions arise. If we can screen out all but the news that interests us most, will we grow parochial? If we shop and pay bills from home and carry less cash, will streets be safer? Must employees who work at home with company computers be electronically monitored? Will children stimulated by computers grow up to find effective cures for poverty, hunger, and war?

These questions were unimaginable in 1959, birth year of the chip, but in a decade they may be current. That would be no surprise, so broadly and swiftly has the chip penetrated our lives.

Recently I spent months gauging the progress and impact of the chip. In laboratories, scientists showed me that the chip, though complex, is understandable. At home a personal computer alternately enraged and enlightened me. And I learned that the chip's every advance incubates another, and that one another and another.

Eventually one billion transistors, or electronic switches, may crowd a single chip, 1,000 times more than possible today. A memory chip of such complexity could store the text of 200 long novels.

Chips refrigerated in ultracold liquid helium make feasible a supercomputer vastly more powerful than any yet built, with a central core as compact as a grapefruit.

Naval scientists envision semi-intelligent and autonomous robots that can pilot ships to evade enemy fire as well as rescue sailors and recover sensitive code books from sunken submarines.

Borrowing techniques from drug manufacturers, chemists hope to grow, not build, future computer circuits.

Farfetched? Then consider these coming innovations in light of some breakthroughs already achieved.

Unperfected but promising microelectronics implanted beneath the scalp can restore very rudimentary sight and hearing to some of the blind and deaf.

Robots that see, feel, and make simple judgments are entering factories, where less capable robots have been "reproducing" themselves for some time.

Within limits, computers can talk, heed our speech, or read. Some diagnose illness, model molecules, or prospect minerals with the reasoning and success of expert human doctors, chemists, and geologists.

The shock waves of the microelectronics explosion expand too far, in too many directions, to tally them all. But a few of the deeper tremors, recorded here, yield a sort of seismic profile of what lies beneath and beyond this first instant in the age of the chip.

"Wish we'd had this chip when we were designing it." Dana Seccombe taps the tiny device in the palm of his hand as tenderly as if it were a rare seed, germ of some plant bred to fruit with money. Just so for his employer, the Hewlett-Packard Company, propagator of computers, calculators, and other electronic cash crops.

Dana, head of chip design at an HP plant in Colorado, passes me the chip. It's a microprocessor and quite a handful, so to speak: 450,000 transistors, laced together by 20 meters of vapor-deposited tungsten "were." Mapping every street and freeway of Los Angeles on the head of a pin would be an equivalent feat—and no harder. That is, in fact, the gist of Dana's complaint.

Every year for more than two decades now, engineers have roughly doubled the number of components on a chip, mainly by shrinking them. They began with soldered wires as thin as cat whiskers. These projected from silicon or germanium crystals sealed in pea-size metal cans. What resembled a three-legged stool was actually a simple electronic switch—a transistor.

The transistor was invented in 1947 at Bell Telephone Laboratories to replace the bulky glass tubes that controlled and amplified electric currents in early TVs and computers such as ENIAC. These vacuum tubes were energy hungry, gave off far more heat than transistors, and frequently burned out.

But the transistor too had a flaw. If often broke off circuit boards, plastic cards embossed with flat, snakelike wires. The remedy, hit on independently by Jack Kilby at Texas Instruments and Robert Noyce at Fairchild Semiconductor: Make the crystal in a transistor serve as its own circuit board. When the snake ate its tail, the integrated circuit—since dubbed the chip—was born.

Today engineers call it the crude oil of electronics, attesting that world dominance in technology rests substantially on the chip. It has strategic virtues indeed.

The chip lacks soldered wires, reducing failure points and making it ultrareliable. (A vacuum-tube computer as complex as Hewlett-Packard's microprocessor would fail in seconds.) Since the chip is tiny, electrical signals take short paths from switch to switch, saving time. Further, a chip carrying 1,000 transistors does more work, faster, than one with ten—at about the same cost.

Lured by this fairy-tale performance and economy, engineers raced to jam transistors on the chip: 5,000 produce a digital watch; 20,000 a pocket calculator; 100,000 a small computer equal to older ones as large as rooms. At 100,000 transistors, you enter "very large-scale integration," or VLSI. The chip engineers joke, comes in grades like olives—large, jumbo, and colossal.

Contemplating the Hewlett-Packard chip—colossal grade—Dana says that to grasp its complexity I must scan its floor plan. He unfurls a roll of drafting paper. Four by eight feet, shingled edge to edge with thousands of squares and rectangles neatly inked in brown and black and green and blue, it's but one section of the chip.

"HOW wide a section, Dana?"

He thinks in microns; one equals thirty-nine millionths of an inch. "Fifteen hundred microns." That's the width of 20 hairs from my head; to spread out the rest of the chip's design would take a gymnasium.

Dana traces a red line form a black square to a green rectangle, symbols denoting transistors and their precisely mated connections. "It takes 100 calculations to position one of these rectangles properly. We mapped two million of them," he adds. Not so odd, his wish for the computing power of a new chip even while still designing it.

Indirectly but obligingly, the chip goes to its own rescue in the guise of computer-aided design, or CAD. A computer built of earlier chips can store diagrams of transistors, rules on how to link them, and data on the intended function of new chips, information that enables the computer to design a chip circuit, display it on a screen, simulate its operation, and report its performance.

Besides plotting transistors, computers also route the interconnections among them. But no computer can yet calculate, in reasonable time, the optimum way to wire a VLSI chip: Possible wiring patterns number in the millions, so complex have chip designs become. Humans must still tediously debug them—hunt for errors, or bugs—and with video screens and attached electronic pens reroute connections or regroup transistors like building blocks.

By 1990 ambitious engineers expect to squeeze ten million transistors on the chip, enlarging it slightly and making it as complex as a city nearly 1,000 miles square. How do you build a megalopolis almost twice the size of Alaska?

Manufacturing any chip is a painstaking, protracted process. Just south of San Francisco Bay, at the Intel Corporation in Silicon Valley, I found that it can take as long as three months to make a microprocessor (see the article about Silicon Valley beginning on page 459).

"Some magic's involved," engineer Ralph Leftwich said as I pulled on a baggy white nylon jump suit, cap, and bootees. Voila! I was a conjurer's illusion in my bunny suit, required fashion in the "clean rooms" where Intel pioneered the microprocessor in 1971 and where filtered air holds fewer than 100 particles of dust or other contaminants per cubic foot. To a microscopic chip circuit, motes are as menacing as boulders.

In one clean room, trays held razor-thin silicon wafers, polished mirror smooth and racked like diminutive records. They were slices of a sausagelike crystal grown from molten silicon so pure that if contaminants were redheads, there would be but 15 of them on earth. Such crystals yield wafers as large as five inches across; each wafer becomes the base of hundreds of chips.

Two things make silicon, a semiconductor, the favored material for chips. Its ability to carry electricity can be precisely altered by ingraining its crystal structure with measured amounts of chemical impurities, or dopants. And silicon surfaces can be conveniently oxidized—rusted, in effect—into an electrically insulating glaze.

"Chips are sandwiches," Ralph said as I peered at a silvery oxidized wafer. He explained that techniques reminiscent of silk screening would stack and stencil the wafer with layers of insulation and crystal, the crystal doped with infinitesimal pockets of impurities laid out in some 300 identical chip-scale circuit patterns (pages 426–7).

"The impurities form conducting areas that overlap from top to bottom of a wafer. By etching 'windows' between them, we create transistors." At the end, with as many as 12 detailed levels demanding interconnection, a wafer receives an aluminum coating and a final etch that leaves conducting filaments invisible to the naked eye.

A new chip's ultrafine "wiring" offers so little entrée to its transistors that they defy individual quality testing. But their collective performance is judged as needlelike probes jab at metal pads on the rim of each chip on a wafer, running 10,000 electrical checks a second. Sound chips are diced from wafers by a diamond saw, then bonded and wired to gold frames and sealed in small ceramic cases propped on stubby plug-in prongs. Packaged, a wafer's worth of chips looks like a swarm of black caterpillars.

This electronic species shelters by the dozens in a personal computer, and in their cocoon they might metamorphose into a journalist's tool as useful as pen or notebook.

So I fancy at home one day, unpacking a personal computer the size of a portable typewriter. And "floppy discs": plastic platters about the diameter of 45-rpm records. Like cassette tapes, they're invisibly patterned with magnetic fields representing information. To make the computer receptive, there's a master disc. A shoebox-shaped "disc drive" that I hook to the computer sends information back and forth between the disc and the computer's chips.

"Slip disc into drive," directs a manual. "Turn on power." The drive purrs, spinning the disc. It stops. Atop the computer, in the upper left of a TV screen—another attachment—there now hovers a small square of light. It blinks. That's all.

Minutes pass. "How's its going?" calls my wife from another room. Flustered, I tell her truthfully: "Nothing to it!"

That maddening, flashing marker on the screen insists on action, so I yank the computer's plug. A sullen scan of the manual discloses what's really needed: a concise chain of instructions—a program—telling the computer what to do, step by step. In my knotted brain a light goes on, followed by another on the screen.

Prompted by the blinking marker, or cursor, I type a practice game program on the computer's keyboard. Now the machine should display a dot, bouncing like a ball back and forth across the screen.

It beeps instead, heralding an error. I give the computer a very personal command not in any manual, then begin debugging.

Choose a starting position for dot is up on the screen, good. So are the commands, if dot on screen, plot new dot position and erase old position. About two dozen other instructions look fine. Wait. I forgot to type: Move dot again. Short one step of logic in its program, the computer simply quit. As might a dim-witted cook given a recipe that fails to instruct: "Bake cake in 350° oven for 50 minutes."

Frustrated and chastened by this machine that demands finicky precision, I can see why last year business and government paid an estimated four billion dollars for ready-made computer programs, or "software." Why by 1990 we may need 1.5 million programmers—more than three times as many as today—to write instructions for computers that issue paychecks, run factories, and target nuclear missiles. And why hundreds of programmers need months to debug 500,000 commands for flight computers aboard the space shuttle.

Fortunately, falling prices for personal computers help swell a rising tide of off-the-shelf programs that make the machines "user friendly." Once only an electronics hobbyist could master a personal computer—by building it. But as the chip reshapes computers into consumer items—some desk-top models cost no more than TV sets, pocket computers even less—they must be simple enought for anyone to use.

To budge money, for example. One program instantly shows a home buyer how changing interest rates affect house payments. Or savings. Programs teach, everything from arithmetic to zoology. Game programs—pinball and chess and monster mazes—may number in the thousands.

With a printer and a word-processing program, the computer I used to write this article shifts, copies, or erases a word, line, paragraph, or page of text, to print cleanly edited manuscripts or letters. It also keeps files and corrects mispellings, Misspellings. Misspellings.

It's the nature of computers, of course, to do these things electronically, by switching, storing, and transforming pulses of electricity. But humans can't understand electrical signals; computers comprehend nothing else.

Yet we do communicate with computers—by translating our numbers, letters, and symbols into a *code* of electical pulses. In computers, by custom, a high-voltage electrical pulse represents the digit 1; a low-voltage signal stands for 0. Because this system is binary (it contains only two digits), the electrical pulses in a computer are called bits, from binary digits.

Electrical pulses representing two digits may seem thin resource for expression, but Lincoln's eloquent Gettysburg Address was telegraphed across Civil War America with only a dot and a dash, the "bits" of Morse code. Similarly, ones and zeros can encode numbers, an alphabet, or even the information in photographs and music.

Many computers, including most personal ones, digest information in chains of eight electrical pulses. These pulse strings—called bytes—shuttle through a computer's chips something like trains in a railroad switchyard. Since a byte consists of eight bits that may stand for either 1 or 0, the "cars" in one of these "trains" can be arranged in 256 (2^8) different ways. That's more than enough combinations to represent uniquely each letter, number, and punctuation mark needed for this article. Or to write the instructions enabling a computer to express and print it.

To carry out instructions, a computer depends on its central processor; in personal computers this "brain" is a single chip—a microprocessor. If you scanned this silicon sliver by microscope, you would notice what might be railroad tracks. These conduct "1" and "0" electrical pulses, passing through the chip at nearly the speed of light.

Alone, a microprocessor cannot hold all the data it needs and creates when working. So memory chips help out. Magnified, they show transistors in intersecting rows and columns, recalling a city street map. This grid allows the microprocessor to assign a byte a unique "address" for instant storage and recall. Most often, a memory chip permits bytes to be retrieved individually, like the numbers in a telephone book. Some such random-access memory chips, or RAMs, can store the equivalent of four copies of the Declaration of Independence.

For Japan, the chip itself is a declaration of independence. In recent years Japanese electronics firms have adopted and refined U.S. technology to win a global lead in RAMs, the vital fuel of the computer industry. Japan's semiconductor samurai also have a reputation for quality and sharp pricing, keys to survival in a fiercely competitive 10-billion-dollar world market for chips. I glimpsed part of it one day in Tokyo's Akihabara district.

This is no tranquil geisha quarter I'm wandering, but a garish electronics bazaar. If it holds a chip, you'll see it here, declares a shopkeeper. He sits nearly hidden in one of hundreds of stalls crammed with everything electronic from cassette players to pocket computers, ballyhooed by huge banners in hot pink and Day-Glo orange.

At many stalls loose chips tumble like jelly beans from bins and boxes. Hobbyists paw through them; so do engineers hunting competitors' chips to study. Keeping tabs on a rival's products isn't easy, for the Japanese output of electronic goods is huge: 16 million TVs, 16 million radios, and 55 million calculators in 1981 alone.

"We face far keener competition in Japan than in the U.S.," says Dr. Matami Yasufuku, executive director of Fujitsu Limited, Japan's largest computer company and a top chip producer. "We Japanese can't afford to dump discount-priced chips overseas."

U.S. competitors claim the Japanese have done just that, to capture 70 percent of the world market for 64K RAMs, chips able to store 65,536 bits of information. ("K" stands for 1,024). The Defense Department worries that U.S. computers, weapons, and telecommunications may grow dangerously dependent on the foreign memory chips. Anxious not to provoke import quotas, the Japanese have cut chip exports and shifted some production to U.S. plants.

Yet Japan's chip makers remain aggressive. Recently they unveiled a new generation of memory chip, with four times the capacity of 64 K RAMs. Their domestic chip plants expand relentlessly too: So many have opened on Kyushu in the past few years that this southernmost of Japan's main isles has been nicknamed Silicon Island.

U.S. rivals, trying themselves to gain or expand a Kyushu toehold, note that in the 1970s Japan's influential Ministry for International Trade and Industry sponsored a national drive to end U.S. dominance in chips. And they complain of Japan's tax breaks, research subsidies, and cheap loans for domestic firms, proof to them that the Japanese will tolerate no threat to a commodity as strategic as the chip.

"We've got a few years of tough competition ahead," concedes Dr. Lewis M. Branscomb, vice president and chief scientist of the International Business Machines Corporation, "as the Japanes exploit the fact that they have given intense interest to manufacturing, productivity, and quality in the past 20 years while Americans were asleep at the wheel." Nonetheless: "I'm much surer of our ability to match them in production and productivity than of their ability to match us in innovation."

Innovation. Lately that word has taken on talismanic overtones in U.S. microelectronics research. Small wonder, considering some of the far-reaching changes brewing in the nature of the chip.

● Design: A squad of engineers needed 18 months to lay out Hewlett-Packard's microprocessor, but university students are now learning to plan complex chips in far less time, using new design principles devised by Professor Carver Mead of the California Institute of Technology and Lynn Conway of the Xerox Corporation.

Significantly, chips designed in this new fashion offer organizational insights that can simplify construction of "parallel processors," computers organized to do all steps of a task simultaneously, like a factory where everyone works at once.

Supercomputers operate somewhat like this now. In hours they run calculations—long-range weather forecasts, for example—that other computers take days to finish. Such speed is expensive; a super unit typically costs ten million dollars. But Dr. Mead believes that with new chip designs supercomputers could be built small and cheap enough to give one to every child.

"The consequences would be awesome," he predicts. "Kids could simulate with utter realism what it's like to pilot a jet, fly by the rings of Saturn, or be jostled by the atoms banging around in a fluid. Think how kids raised with such computers would transform society. There's nothing they wouldn't believe they could handle."

Manufacture: Shrinking microcircuits put a premium on new tools to make chips with exquisite precision. At an IBM plant in eastern New York, beams of electrons transfer chip designs directly from computers to wafers. And they do it with an accuracy comparable to a skipper holding his ship within 525 feet of its course throughout a voyage from New York to New Orleans.

Such beams have unmatched potential to pattern wafers with incredibly fine circuits. At the National Research and Resource Facility for Submicron Structures at

Cornell University, Dr. Michael Isaacson has carved into salt crystals letters so tiny that a 30-volume encylopoedia could be written on a chip the size of a half-dollar

Materials: Other scientists try building chip circuits, atom by atom, of chemicals beamed at wafers. The goal of such "molecular beam epitaxy" is more transistors on chips, packed in three-dimensional rather than flat arrays. The process can also sheet wafers with layers of gallium and arsenic compounds that conduct electricity ten times as fast as silicon.

The drive to cram more components on the chip may end in a test tube, says chemist Forrest L. Carter of the U.S. Naval Research Laboratory in Washington, D.C. Dr. Carter thinks that relatively soon molecule-size computer switches will by synthesized from inorganic chemicals, like some drugs. Then, within 30 years, we could be jamming a cubic centimeter "with a million billion molecular switches, more, probably, than all transistors ever made."

From Bell Telephone Laboratories scientist Andrew Bobeck has come the magnetic bubble memory. On this chip, bubble-shaped magnetic areas in a film of garnet crystal store such computerized messages as, "We're sorry, but the number you have reached has been changed to. . . ." One day, Bobeck told me, a bubble chip the size of a postage stamp will hold the contents of a small phone book.

Researchers at Bell Labs, IBM, and elsewhere are refining Josephson junctions—electronic switches made of metals that lose all resistance to electric current when chilled to near absolute zero. Chips with these devices can switch signals in seven-trillionths of a second, presaging ultrafast telephone switching equipment, or a refrigerated supercomputer. Its chilled, circuits could be packed into the volume of a grapefruit, cutting travel time for signals and enabling the machine to carry out 60 million instructions a second, ten times as many as current high-performance computers.

IBM hopes to build a prototype in a few years. "Could it be of commercial significance?" IBM's Dr. Branscomb baited me. "I'll tell you in the 1990s."

By then the Japanese may have created a thinking computer. Memory-chip successes have inspired the Ministry for International Trade and Industry to launch work on a machine that may win Japan command of the technological revolution being sparked by the chip.

In Tokyo, MITI official Sozaburo Okamatsu told me: "Because we have only limited natural resources, we need a Japanese technological lead to earn money for food, oil, and coal. Until recently, we chased foreign technology, but this time we'll pioneer a second computer revolution. If we don't, we won't survive."

MITI expects to have a prototype of the thinking computer by 1990, and a commercial product about five years later. "It will be easy to use," Okamatsu projected. "By recognizing natural speech and written language, it will translate and type documents automatically. All you'll have to do is speak a command. If the machine doesn't understand, it will talk—ask questions. It will draw inferences and make its own judgments, based on knowledge of meanings as well as of numbers. It will learn too, by recalling and studying its errors."

This vision of artificial intelligence—machines acting in ways humans regard as intelligent—unnerved me, so I sought out computer scientist Edward Feigenbaum at Stanford University. The Japanese, too, had asked his opinion of the thinking computer project.

"I told them it was the right idea at the right time," he said. "Artificial intelligence is a great scientific challenge. The more people working on AI, the better."

Artificial intelligence is as much art as science. Under Dr. Feigenbaum, "knowledge engineers" tease from human experts factual knowledge and the sometimes unrecognized rules of thumb they use to apply it. Encoded in programs, such information already allows computers to plan genetics experiments, deduce the structure of molecules, and diagnose diseases.

Future "expert systems" may advise chip designers, soldiers who must troubleshoot complex weapons, even plant lovers, as the programs gradually become everyday consultants. "Imagine one helping you nurse your sick houseplants," suggested Dr. Feigenbaum.

At the University of Pittsburgh, computer scientist Harry Pople and intermal-medicine specialist Jack D. Myers have created Caduceus, a program that catalogs more diseases than a doctor could possibly remember and that enables a computer to combine facts and judgment and make a multiple diagnosis. "Like your brain, it can shift gears from disease to disease," Dr. Myers told me. "I'll show you."

Into a computer went details about an elderly man rushed one night to the university hospital. He'd awakened panicky and short of breath. Heart attack? "My first guess," said Dr. Myers.

Considering the case—no chest pain, an earlier heart attack, blood pressure normal, a history of diabetes—Othe computer weighed and momentarily set aside more than a dozen diseases before ffashing a message about a prime suspect. Pursuing: diabetes mellitus.

The computer asked about the man's blood-sugar level. Quite high. It asked other questions to clinch matters, then announced conclude: diabetes mellitus.

More questions probed breathing sounds, heart murmurs, chest X rays. . . . In minutes the computer also judged the patient a heart-attack victim. His doctor had taken several days to decide as much, with doubts.

In complex or unusual cases, Caduceus makes a sounder diagnosis than general practitioners, says Dr. Myers, and almost always agrees with the specialist who has time to study a patient's every symptom. After more testing, Caduceus could become a common doctor's adviser, and may even lower medical costs as physicians prescribe fewer but more suitable tests to answer a computer's questions about patients.

Also in Pittsburgh, Nobelist Herbert A. Simon teaches computers sweet reason with a program that seeks orderly patterns in irregular data and thereby hits on predictable laws of nature. This approximates the intuitive thinking of human scientists.

Named for Elizabethan philosopher and scientist Sir Francis Bacon, the program has independently rediscovered laws of planetary motion and electrical resistance, as well as the concept of atomic weight. Could Bacon discover an unknown natural law?

"Maybe, but the main goal is learning how the mind works," Dr. Simon told me at Carnegie-Mellon University. "I grew up in a computerless world," he said, "amid vague ideas about thought and the brain. Computers, when you try to program them to act like us, shed great light on such things."

And could a computer, I asked, win a Nobel prize? "The Nobel Committee may yet have to think about that."

Wherever the discussion turns to thinking machines, the name Marvin Minsky comes up. Professor of computer science at Massachusetts Institute of Technology, he believes self-conscious and truly intelligent computers and robots are a distant certainty. They may be as inscrutable as humans, he adds:

"The notion that computers do only what they're told is misleading. If you can't tell a computer how best to do something, you program it to try many approaches. If someone later says the machine did as told, that's ambiguous—you didn't specify and couldn't know which approach it would choose. That doesn't necessarily mean we can't control an intelligent computer, just that we won't always know every detail of what it has in mind."

That prospect may upset some adults, but children would likely take it in stride, as they have the more than 100,000 personal computers and computer terminals in U.S. classrooms.

As the chip has cut their cost and advanced their use in schools, personal computers have refueled an old debate about the value and purpose of teaching machines. In Minnesota, where nearly all children 6 to 18 attend schools equipped with classroom computers, I saw third graders use one for rote grammar drill. The machine freed their teacher for true teaching, but it somehow seemed a costly alternative to flash cards.

Many education experts say the potential of school computers has been barely tapped, either to present subjects that boost analytic skills or to make children computer literate—able to run computers and grasp their impact on society. By that measure, most kids still grow up computer dropouts, possibly dooming them to be "know nots."

"The chip is remaking this into a world where information is literally wealth," says Peter Schwartz, former head of Future Studies at SRI International, a California think tank. "Without equal skill in using computers to get and employ information, people may divide into 'knows' and 'know nots' and suffer or prosper accordingly."

These cares have yet to burden Stacey, a second grader at P.S. 41 in New York City. I watched as she giggled and pecked at the keyboard of a personal computer loaned by the LOGO Computer Learning Center, also in New York. Soon the computer was drawing triangles within triangles, and Stacey was challenging a classmate to find them all.

Afterward, at the center, I confessed to associate director Dr. Robert W. Lawler my chagrin at seeing seven-year/olds juggle abstractions that had nearly bested me in high-school geometry. It's not uncommon, he assured me, for a child with a computer to learn more at a younger age.

"But the profoundest effect of computers on children," he went on, "may be to make them relfect on how they think." As Stacey had told me, nodding at her computer screen, "I try to make it like my head sees it."

On another front—a battlefront—children are dueling robots, blasting missiles, and zapping aliens in mock clashes programmed into video-game chips. Perhaps as many as 30 billion quarters are fed annually into coin-operated video games; that they tempt children to truancy or theft any more than other pastimes is, according to the industry, an unfounded fear.

Versions for home TV and new emphasis on strategy over mayhem blunt most objections to video games. Some seven million U.S. households have them now, and Atari Incorporated, the world's largest maker of video games, expects that number to at least triple before finally peaking.

U.S. Army tank gun crews have also been toying with the chip, built into training simulators modeled on a video game. Like that diversion, the simulators stir aggressive impulses, and troops gladly practice more, without the peril and expense of real tank maneuvers.

Robot soldiers have no place in Pentagon planning yet, but the Army will soon test a robot ammunition handler with chips for a "brain." A mechanical arm flexing hydraulic "muscles" and a pneumatic gripper "hand," it will hoist and arm 200-pound howitzer shells, duty that now fatigues and endangers four GIs.

Cosmetically, today's robots lag lightyears behind the sleek androids of science fiction. Yet in dozens of industries chip-smart robots draw admiring looks for raising productivity as they tirelessly paint cars, weld ships, feed forges, and more. The hulking "steel collar workers" toiling in such jobs resemble counterbalanced beams set on boxes full of electronics. Other, small robot arms have shoulder, elbow, and wrist joints nimble enough to assemble electric motors or jiggle dainty light bulbs into automobile instrument panels. Some machines have more finesse, but none match the versatility of a robot: All it needs to switch jobs is a new tool at the end of its arm and a new program in its chips.

So an electrician tells me at a Chrysler assembly plant in Delaware. He oversees 30 robot welders and unselfconsciously calls them his. They crane and thrust like giant, long-necked vultures, made restive and quizzical by the skeletal car frames passing their perches. In two rows they seesaw over the steel bodies, diligently and fastidiously gripping them in C-shaped beaks. Air hoses hiss and convulse, the long necks shiver, and the snouts froth white sparks, wringing crackling arcs of heat and light from the clamped, welded steel.

Where once 30 men sweated to weld 60 cars an hour, the faster robots now handle as many as 100, and the electrician has time to smoke his pipe. Waving it at the robots, he says they're more consistent too. "If they weld right the first time, they weld right every time, Mondays and Fridays included."

I heard more praise as a General Motors plant in Ohio: Robots work overtime without extra pay, cut defects and waste, never strike. . . . I also saw robots measure car-door openings with laser "eyes," one of many additions—tactile sensors, TV cameras, infrared probes—making robots increasingly productive. So much so that by 1990 GM hopes to be using ten times the 1,600 robots it has today.

Manufacturers and engineers talk more and more of fully automated factories, making computer-designed goods with mass-production economy and the distinction of custom detail. The Boeing Commercial Airplane Company is taking off that way now, lofted by the chip's cheap computing power. Filling orders for ten jets, each with unique seating, Boeing builds them all together, but to computer-customized blueprints. It's easy, because a robotlike device drills holes wherever wanted with just a change in program, dictated by a design computer.

Today's most advanced factory may be in Japan. In the Fanuc Ltd. plant near Mount Fuji, I saw unattended carts glide to automatic storage racks, accept metal blocks, and then roll to robots; they loaded the metal into unmanned drill presses and lathes to be shaped into parts for more computerized tools and robots. On a shop floor bigger than a football field I saw but 15 human workers.

Japan claims roughly half the world's 25,000 or so robots, and Dr. James S. Albus, a robotics expert at the U.S. National Bureau of Standards, likens that technological head start to an earlier one: "Japan has given us another Sputnik."

Mulling the U.S. robot revolution coming in reply—and the jobs that will inevitably disappear—MIT automation researcher Harley Shaiken cautions that robots and the chip differ in a major ways from previous waves of mechanization.

"This technology affects offices as well as factories," he told me. "It creates a potential economic vise: One jaw shoves people from the plant, and the other limits their shift to white-collar jobs." Shaiken concludes that without retraining programs and new jobs, we invite severe economic dislocations.

"We're creating jobs in the long run," responds Stanley Polcyn, president of the Robot Institute of America and senior vice president of Unimation, Inc., a major producer of robots. This nation has only about 6,000 now, he notes, adding that to meet demand for more, the robotics industry itself will hire great numbers of workers.

Then there are the new job markets robots will open, like deep-sea mining. Or repair of home robots. In five years, predicts Plocyn, the first modestly useful but very expensive ones should be housebroken.

Another fixture of futuristic forecasts—the electronic newspaper—is already here. More than a dozen dailies now publish an edition without cutting a tree or inking a press. "You can't give a kid separate editions for the lawyers, laborers, and housewives on his paper route," points out Elizabeth Loker, who helped develop an electronic edition of the *Washington Post*. It goes out over telephone lines to personal computers, and subscribers choose what they'll read from a menu on their screens, instead of hefting an entire paper off the front step. "Electronic delivery lets every reader assemble his own newspaper," says Loker.

Reading news on a computer screen for an hourly fee can tax the eyes and the wallet—an electronic version of a 25-cent paper could easily cost ten dollars. But publishers believe that shoppers will pay for up-to-the-minute advertising, a moneymaker that also attracts the American Telephone and Telegraph Company. A possible future rival of newspapers, AT&T has already tested an electronic edition of the Yellow Pages.

At Bell Labs, the research arm of AT&T, I learned a primary cause of such changes. "Each time microelectronics cuts computing costs by a factor of ten," explained Dr. John S. Mayo, executive vice president for network systems, "it opens a vast array of things that were once uneconomic."

Like the teleterminal Dr. Mayo showed me: a combination telephone and computer terminal, with a compact keyboard and screen. The desk-top device logs his appointments, finds phone numbers, makes calls, sends and receives memos, and displays files—all at the tap of a few buttons.

Though experimental, Bell's teleterminal exemplifies the chip's power to alter the way we work, or even where we work.

"In 20 years a significant number of us—not just craftsmen or entrepreneurs—will work at home, using computers and dealing with our offices by electronic mail," says Dr. Margrethe H. Olson. The New York University professor advises corporations considering how to attract or keep workers who dislike commuting, have small children, or are homebound by handicaps.

Some bank and insurance company employees "telecommute" now, a trend, Dr. Olson told me, with subtle implications. "The nine-to-five workday will grow artificial. Sick leave, vacation, and pension policies will change. So will the separation of work and family and the concept of leisure time—what you do with it, and when."

At Columbia University, professor of public law and government Alan F. Westin spoke of a potentially worrisome aspect of working with the chip.

"Word processors and computer terminals can keep us under surveillance," he said. "A boss can know how many keystrokes a secretary makes in a minute, hour, or day. At insensitive companies new technology may be an opportunity to grip workers totally."

A decade ago Dr. Westin headed national studies of inquisitive centralized computer data banks, research that led to new federal privacy laws. He sees another challenge to our privacy in this decade.

"With personal computers and two-way TV," he said, "we'll create a wealth of personal information and scarcely notice it leaving the house. We'll bank at home, hook up to electronic security systems, and connect to automatic climate controllers. The TV will know what X-rated movies we watch. There will be tremendous incentive to record this information for market reseach or sale."

While some ponder how to shield sensitive information lodged in the ubiquitous chip, other contrive to tap it—for revenge, for fun, for profit. All three motives have figured in computer crimes.

Computers are woefully corruptible. Files can be altered, unauthorized commands can be added to programs, and legitimate ones misused, often without discovery. Nor does this take great skill: In tests, amateurs have penetrated the defenses of even classified military computers.

In recent years experts have put the cost of push-button capers at 100 million to 6.5 billion dollars annually. But undetected and unreported computer crimes make estimates suspect, cautions one authority, Donn B. Parker. He calculates that known computer frauds—a limited sample—typically cost their victims about half a

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million dollars. And the potential for plunder is sobering: Daily now, banks transfer more than 500 billion dollars around the U.S. by computer.

Electronic lawbreakers may hit harder and more often in the future, as personal computers multiply the means to penetrate computer systems and dramatically increase the number of people familiar with them. Drug runners and bookmakers already use personal computers, and other organized criminals will likely make them outright accomplices.

Teenagers, as easily as if vandalizing empty houses, have wrought long-distance havoc with their keyboards. Using telephone lines as a link, two California boys tampered with racehorse and greyhound pedigrees stored in a computer in Kentucky, and for a time the files of some Canadian corporations were an open book to youngsters at school computers in Manhattan.

Children of their time, you may lament, making mischief in a fashion ushered in with incredible rapidity by the chip. With such swiftness that you may conclude a revolution in our lives is well under way.

Yet it has hardly begun. In decades to come the technology of this age of the chip will surely seem minor, gradually dwarfed by its sweeping social effects.

Some will come as we put the chip to new uses. Chips aside, the latest artificial limbs and organs are not fundamentally new—unlike the microcircuits some scientists speculate we may one day implant in our heads to augment our intelligence.

As well, the chip will add new dimensions to old social issues. In an economy based on robots, how will we share wealth, now commonly distributed in the form of jobs?

Deepest change of all, the chip will alter our self-image. Apes that master sign language and use tools have already shaken the idea that to have ideas is to be human, a view likely to decline even further if machines too begin thinking.

Such profound adjustments seem to be the unavoidable and unsettling price of living in the age of the chip. But not too great a price, for in paying it we stand to gain the benefit of exercising some of our best virtues: patience, flexibility, wisdom.

B. MATERIALS SUBMITTED BY THOMAS DUNLAP AND RICHARD STERN

CHIPS

0 CHIP - A COLLECTION OF TRANSISTORS ON A SINGLE STRUCTURE WHICH WORK TOGETHER TO PERFORM A PARTICULAR ELECTRONIC FUNCTION.

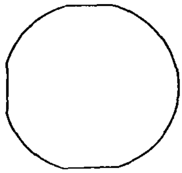
0 CHIPS ARE USED AS THE BRAINS AND MEMORIES OF:

AUTOMOBILE FUEL AND OMISSION CONTROL SYSTEMS
ROBOTICS
MINICOMPUTERS
MAINFRAME COMPUTERS
CALCULATORS
TELECOMMUNICATION EQUIPMENT
ELECTRONIC GAMES
MEDICAL EQUIPMENT
WORD PROCESSING EQUIPMENT
COMPUTER AIDED DESIGN/COMPUTER AIDED MANUFACTURING EQUIPMENT (CAD/CAM)

0 BASIC BUILDING BLOCK OF A CHIP IS A TRANSISTOR.

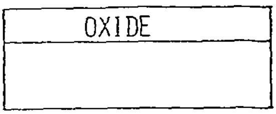
0 THE TRANSISTOR IS FABRICATED ON A MATERIAL KNOWN AS A SEMICONDUCTOR (TYPICALLY SILICON).

PRODUCTION OF A CHIP

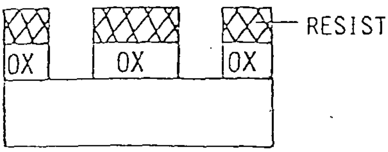


WAFER - A THIN SUBSTRATE (TYPICALLY SILICON) ON WHICH TRANSISTORS AND CHIPS ARE FORMED.

<u>WAFER PROCESSING</u>



0 GROW A THIN OXIDE OVER THE ENTIRE SURFACE OF THE WAFER.



0 COAT THE WAFER WITH A PHOTO RESISTIVE FILM.

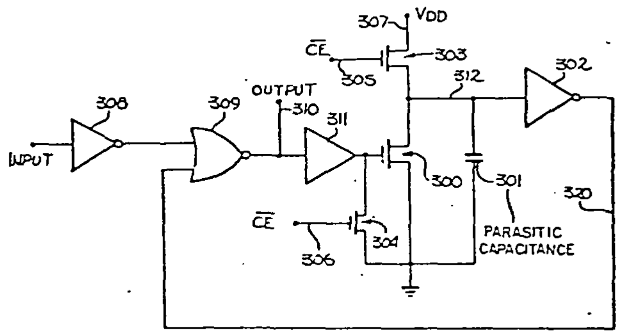
0 * IMPRINT A PATTERN ON THE FILM.

0 SELECTIVELY REMOVE PORTIONS OF THE RESIST.

* THE SEMICONDUCTOR CHIP PROTECTION ACT IS INTENDED TO PROTECT THESE PATTERNS

HOW TO DESIGN A CHIP

0 A CIRCUIT DESIGN ENGINEER DEVELOPS A CIRCUIT TO IMPLEMENT THE ELECTRONIC FUNCTION OF THE CHIP. A "SCHEMATIC" REPRESENTATION IS USED TO DOCUMENT THE ELECTRONIC FUNCTION. (CAN BE PATENTED)



0 A LAYOUT DESIGN ENGINEER TRANSFERS THE CIRCUIT DESIGN INTO A SET OF PATTERNS WHICH WILL EVENTUALLY BE IMPRINTED ON A WAFER TO FORM A CHIP. ("MASK WORK")

0 THE LAYOUT WILL BE EMBODIED ON A MAGNETIC TAPE.

0 A "MASK" IS MADE FROM THE TAPE FOR EACH PATTERN. MASKS ARE GLASS OR METAL PLATES WITH A SINGLE PATTERN IMPRINTED ON THEM BUT THE MASK CONTAINS PATTERNS FOR MULTIPLE CHIPS.

0 THE MASKS ARE PLACED IN A PRINTER (CAMERA).

0 THE PRINTER IMPRINTS THE PATTERN ON THE WAFER.

HOW TO COPY A CHIP

- 0 SECTION 4(3)(A) OF THE ACT CALLS IT EMBODYING A MASK WORK IN A MASK.
- 0 OBTAIN PUBLICLY AVAILABLE PACKAGED CHIP.
- 0 TAKE OFF THE LID.
- 0 PHOTOGRAPH THE CHIP.
- 0 CAREFULLY MEASURE THE TOP LAYER OF THE CHIP AND DRAW IT ON PAPER OR ON A COMPUTER.
- 0 ETCH OFF ONE LAYER AT A TIME AND CAREFULLY MEASURE THE NEXT LAYER UNTIL YOU HAVE MEASURED EACH LAYER OF THE CHIP.
- 0 YOU NOW HAVE A TAPE WHICH CAN BE COPIED INTO THE VARIOUS FORMS THAT YOU NEED TO MANUFACTURE THE CHIP.

FAIR REVERSE ENGINEERING

- O THIS IS EQUIVALENT TO WRITING A COPYRIGHTED BIOGRAPHY. A SECOND WRITER CAN WRITE A BIOGRAPHY ON THE SAME PERSON AS LONG AS IT IS EXPRESSED IN A DIFFERENT MANNER.

- O STUDY THE OPERATION AND DESIGN OF THE CHIP.

- O IMPLEMENT THE SAME ELECTRONIC FUNCTIONS BUT USING DIFFERENT PATTERNS.

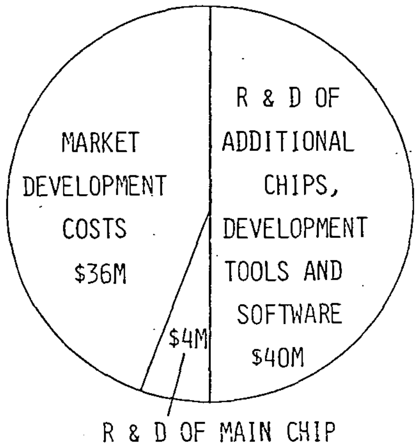
- O REDUCE THE COST AND/OR IMPROVE THE PERFORMANCE OF THE CHIP.

- O REVERSE ENGINEERING MAY COST 25% OF THE ORIGINAL DESIGN BUT IT ALSO ADVANCES THE STATE OF THE ART.

- O IT IS THE EXPRESSION WHICH SHOULD BE PROTECTED NOT THE UNDERLYING CIRCUIT CONCEPTS.

TYPICAL DEVELOPMENT COSTS

0 TYPICAL COST OF A COMPLETE FAMILY OF CHIPS = $80M

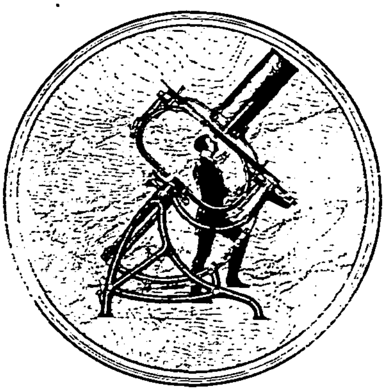


0 ON GOING R & D COST ABOUT $10M PER YEAR.

0 REVERSE ENGINEERING OF THE MAIN CHIP WOULD COST ABOUT $1M. WE CAN LIVE WITH THIS.

0 PHOTOGRAPHIC COPY OF THE MAIN CHIP WOULD ONLY COST ABOUT $100,000.

0 THE PIRATE HAS MINIMAL R & D COSTS AND VIRTUALLY NO MARKET DEVELOPMENT COSTS. PRICE IS HIS ONLY WEAPON.



From Relays to MPU's

Robert N. Noyce
Intel Corporation

Introduction

When the IEEE Computer Society was founded twenty-five years ago, the transistor was a laboratory curiosity, and operating computers were assembled from relays or vacuum tubes. Today, a single integrated circuit far surpasses the capability of those early computers, and further progress seems inevitable. The development of semiconductor devices has depended upon a synergism with computers. This is particularly true for integrated circuits, whose development was motivated by the computer applications. With each advance in components, the computers resulting from their use reached a wider market, motivating further advances in the semiconductor technology.

Improvements in cost, reliability, and performance were the major objectives of the component development programs. Each has been improved by higher levels of complexity of integrated circuits. In assessing whether this technology is entering its maturity or its dotage, we should ask if significant additional improvements can be made in these three factors.

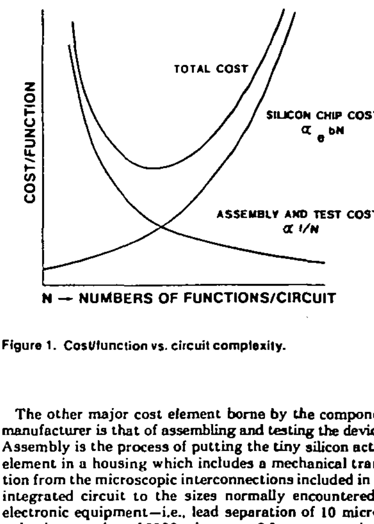


Figure 1. Cost/function vs. circuit complexity.

Costs

After design has been amortized, the production costs are made up of two basic elements: first that of the active element (today, usually silicon) and then assembly and test costs. The silicon chip cost is dependent upon the processing cost per chip and the yield of good chips. There is a limit to the size of the silicon chip which may be made with practical yield. A simple model would say that if a given size chip yielded only 10% good chips due to the inclusion of random defects, then a chip twice as large *would yield only 1% good chips. (Actually the situation* is not this bad, since defects are not randomly distributed.) The cost for twice the function then would be 20 times as great (twice the processing cost since twice the area of silicon is used, and 10 times the cost due to loss of yield). Clearly, if the cost of the active silicon is dominant, such a doubling of complexity would not be cost-effective, and carried to an extreme, the single transistor is the most cost-effective. (See Figure 1.)

The other major cost element borne by the component manufacturer is that of assembling and testing the devices. Assembly is the process of putting the tiny silicon active element in a housing which includes a mechanical transition from the microscopic interconnections included in the integrated circuit to the sizes normally encountered in electronic equipment—i.e., lead separation of 10 microns to lead separation of 2500 microns or 2.5 mm respectively. As a first approximation, assembly costs are independent of the function included on the integrated circuit chip, although they will increase somewhat with the increasing number of *electrical connections to large chips.* Similarly, test costs increase much more slowly than the complexity of the chip being tested, although very sophisticated test equipment is required to achieve this result.

Thus, the total cost per function will be made up of two elements, one increasing with complexity of the general form ae^{bN}, representing the cost of the silicon chip, and another of the form c/N representing the cost of assembly and test, where N is the number of functions included.

This cost will have a minimum, as indicated in Figure 1. As processes for manufacturing integrated circuits have been perfected and yields of good circuits have been improved, this minimum cost point has moved to circuits of higher complexity. It has been the strategy of the semiconductor device manufacturers to supply circuits which are near this minimum at any given time.

An examination of the integrated circuits offered by the industry as a function of time provides an approximation of how the minimum cost point has moved up with time, even though a particular product offering will occur somewhat before that product is cost-effective. The minimum cost/function point has been moving up in complexity, doubling every year since the introduction of the integrated circuit (as indicated in Figure 2). If the present rates of increase of complexity were to continue, integrated circuits with 10'' elements would be available in 20 years!

This increase in complexity has resulted in a cost savings in the subsequent assembly into computer hardware as well, since more of the total interconnections are made within the semiconductor components. Other advantages have also accrued. Because equipment can be made smaller, speeds can be improved, costs of cabinets and cables reduced, and total power and cooling requirements reduced.

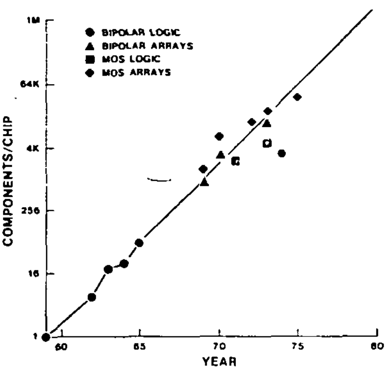


Figure 2. Circuit complexity vs. time of introduction.

Reliability

The interconnections within the integrated circuit have proven to be more reliable than the next level of interconnections, such as solder joints, or connectors. The reliability of the individual integrated circuit at time of introduction has remained nearly constant, independent of its complexity, resulting in a drastic reduction in failure rate on a per-function basis, as more complex circuits have been made available. Further improvement has been made by the reduction of the number of the less reliable solder joints and connectors. Even higher levels of integration can be expected to yield additional reliability dividends.

Performance

As dimensions decrease, all the device parameters change in a favorable direction. This can be seen by noting how the transistor parameters change with dimension, maintaining internal fields, which are limited by avalanche breakdown or, at lower voltages, quantum mechanical tunnelling. The parameters change as follows:

- operating voltages will vary as x, the characteristic dimension;
- charge densities will vary as $1/x$;
- device current will vary as x;
- power density will be constant;
- the characteristic impedance will be constant;
- circuit delay times due to capacitive charging will vary as x;
- device transit times will vary as x;
- iR drops along interconnections are constant.

The fundamental limit which will be encountered is the requirement that significant nonlinearity is required in digital circuits for stability. This condition requires that the logic voltage swings (ΔV) be large compared to KT/q. Assuming 300° operations, $\Delta V \gg 0.025$ volts.

Thus, the signal levels of common logic forms can be reduced by a factor of approximately 10 before encountering this limit. A corresponding decrease in characteristic dimensions is implied with a circuit density increase of 100. Interconnect voltage drops, not a significant problem in most circuits today, will have to be improved by a smaller factor, depending on the circuit forms.

Futures

Cost, reliability, and performance all improve with smaller devices and higher levels of integration. Device size is determined by the smallest practical line widths, while the economical level of integration depends upon this factor and the practical size of silicon chips.

The minimum average dimension used in IC's is shown in Figure 3, plotted as a function of time. Production technology has moved quickly from the pre-1960 dimension of 100 microns to the 10-micron range following the introduction of photolithography as a method of defining the geometry of transistors. Steady improvement has been made since that time as equipment and methods have been improved. Recent production technology can utilize 4-micron widths, and laboratory work involves significantly smaller dimensions. These widths also define not only the size of interconnection patterns but also the source-

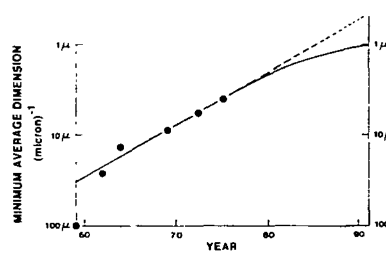


Figure 3. Minimum average dimension.

drain spacing in MOS transistors and the emitter-base contact spacing in bipolar transistors, which in turn are primary determinants of the performance of these transistors.

Minimum dimensions will continue to decrease but at a decreasing rate as optical limits are approached, *reaching 2 microns in 5 years, and 1 micron in 15 years.* Scaling arguments show that speed should then increase by 4 times by 1991.

Die size limitations are set by the economics of "yield." *Many circuits are made, the defective ones are thrown away, and the good ones are sold.* Defects can arise from many sources. The photomasks used may have pin holes in dark areas, or opaque specks in areas which should be clear. Severe defects in the basic silicon crystal can make the circuit inoperative. Dust in the photoprinting operation or other processing steps, which affects a critical spot in the circuit will cause failures. Errors of misaligning successive photoengraving steps, or of lack of control of critical dimensions and impurity concentration will make the circuit inoperative. The correction and elimination of these defects is a difficult task, and represents a major portion of the effort and expense of semiconductor device development and production.

However, there is no indication that any fundamental limit exist. Progress continues at a rate which is advantageous and can be economically justified. If defect densities are reduced as they have been in the past, chip sizes will increase by 3 times in 5 years, and 25 times in 15 years, as shown in Figure 4.

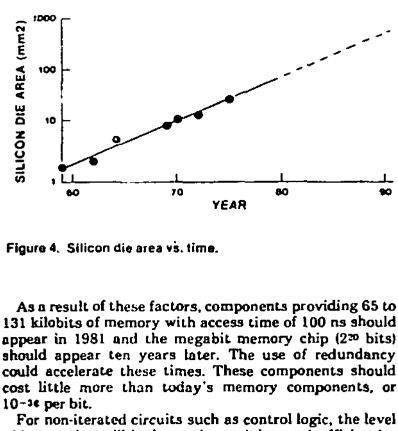


Figure 4. Silicon die area vs. time.

As a result of these factors, components providing 65 to 131 kilobits of memory with access time of 100 ns should appear in 1981 and the megabit memory chip (2^{20} bits) should appear ten years later. The use of redundancy could accelerate these times. These components should cost little more than today's memory components, or 10^{-3}¢ per bit.

For non-iterated circuits such as control logic, the level of integration will be lower due to inherent inefficiencies *in packing random logic. However, the levels which could* be achieved in five years would be approximately 25,000 gates, and in 10 years about 250,000 gates. These numbers exceed the gate count of today's medium and large processors, respectively. *Internal gate delays* of these systems would be comparable to those of today's high speed computers. If the amortization of design costs could be neglected, such logic arrays could be produced for less than $100, or a cost of less than 0.4¢ per gate in five years and less than 0.04¢ per gate in 15 years. (See Figure 5.)

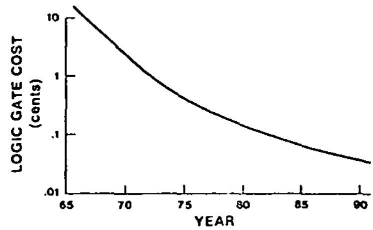


Figure 5. Logic cost vs. time.

It is perhaps obvious that with the increasing complexity of integrated circuits the design cost has been increasing. Although computer-aided design is utilized more and more widely, the cost of design of a new microprocessor is orders of magnitude more expensive than the design of a quad gate. Yet for many applications, the overall design costs can be lower, since component design includes many of the costs previously part of the equipment design. This is particularly true where the cost of the design of one microcomputer can be shared by many different applications.

The microcomputer thus serves as an example of a way out of the dilemma which the components industry encountered as LSI was becoming economically feasible. With increasing complexity the number of possible unique circuits increases enormously, and the cost of design of each increases enormously. Thus, only high-volume appli*cations for which the design costs were small compared* to the production costs could utilize this new technology. Early applications were then limited to calculators or semiconductor memories. The advent of the microprocessor unit, or MPU, neatly sidesteps *this* issue by leaving the uniqueness for the individual application in an area where flexibility is easy to achieve—in software or memory. Although software cost came as an unexpected expense to the components industry, it is still far less than the cost of individual design of unique circuits for each application. Furthermore, undertaking the cost of design of the MPU is less risky; with many potential applications, its market success does not depend on the success of a single program.

Improvement in production techniques of the MPU will result naturally from the high-volume production of semiconductor memories. The complexity of the MPU can be expected to follow that of semiconductor memories with a time lag of a year or two needed for architectural and logic design of the more complex MPU. The eventual cost, if large markets are developed, will be no more than any LSI circuit of similar size and complexity, after amortization of design and software cost.

The implications of this cost decline for sophisticated computing power are enormous. We have had a glimpse of the changes which can be expected from the development of the calculator market. Ten years ago it would have been difficult to predict that the calculator would displace the slide rule. Today, it is equally as difficult to predict what displacements are in store for the next decade or two.

The capabilities of the microcomputer system, which can be purchased for the price of an automobile, is comparable to that of a medium-scale computer of a decade ago. And tomorrow the personal computer could become as much a necessity to the individual consumer as the automobile is today.

It has been suggested that the MPU is the equivalent to the development of the fractional horse power motor—it will appear everywhere in our daily lives, whether turning the hands of a clock, or running a dishwasher. The computer has had little fundamental effect on the life-style of individuals up until now. But with the proliferation of readily available inexpensive computing power, we can expect drastic changes in the future.

Dudley Buck, the inventor of the cryotron, said 20 years ago that he was too old to go to the moon, but with electronics he could feel that he was there. Arthur C. Clarke, in a marvelous look at the future, writes of the tele-safari, "Don't commute, communicate!"[1] The author knows of more than one case where a computer terminal has displaced an automobile for commuting to work.

Other human activities can be expected to change. For entertainment, we might compose and perform our own symphonies, or operas, or write our own motion pictures. We could provide the individual with access to the libraries of the world from his armchair, or programmed instruction on the subject of his choice. His typewriter could displace the postal service, as his completed letter is automatically typed out on the addressee's typewriter. As costs decrease, the use of the computer, which has been the province of large organizations, will extend to individuals, first to the few, then to many. Long-hoped-for miracles of restoring sight (or its near equivalent) to the blind should become economically advantageous. On a broader scale, the work force in service activities, more than half of the total work force, will be helped by the amplification of intelligence using the computer, just as manual labor was enhanced by using power equipment.

The engineering profession has progressed by building on past experience, taking past accomplishments as a starting point to set new objectives. The results of yesterday's research projects becomes the handbook data for today's design activities. We have seen this progression in the development of semiconductor technology in the last 25 years, as the design activities progressed to higher levels. Thus, pushing to higher performance levels, the results of transistor design were assumed as the integrated circuit was designed. These elemental circuits were assumed as MSI was designed, and the MSI building blocks were used to produce LSI designs. Similarly, the basic processing techniques of material purification, alloying, diffusion, photolithography, epitaxial growth, and ion implantation were successively assumed as new production techniques were being developed.

The background knowledge useful to the practitioner has shifted, as the field has matured. Initially, the fundamental physics and chemistry of semiconductor materials were key as problems were centered in these areas. As solutions to these problems were reached, basic circuit theory became more critical when transistors were designed to specific applications. Circuit theory gave way to logic design, then to systems architecture and software as the pivotal points where the greatest progress was made.

Today, we see the integration of all disciplines in design of new systems with each contributing to the new design. The future progress will be dependent upon reaching the frontiers via the paths of previous work, or upon finding errors or omissions in the work of earlier pathfinders. Success will be dependent upon detailing areas which have been explored in a cursory fashion, or upon having a broad understanding of the potential applications, and method is available to satisfy these requirements, including not only the devices themselves but the software necessary to make these devices useful.

Industry structure

Even the structure of the electronics industry has been changed as a result of higher levels of integration. Activities once considered quite independent of component design now are becoming an integral part of the component manufacturer's activity. Mucb of circuit design has been included in IC development, and much of architectural and software design is now included in the development of the MPU.

Stable applications of LSI, such as the calculator, have become the province of the companies which are integrated from device design to end product. We may expect that other products will follow as equipment manufacturers assume LSI design responsibility, or companies with the LSI capabilities find new areas of application for their capabilities. I believe, however, that the greatest advances will result from the traditional synergism of the computer and component disciplines, each concentrating in its own areas of expertise, while trying to understand the prospects and problems of the other. The component discipline approaches the problems from the "how to" point of view; the computer discipline from the "what to do" point of view. Both are necessary to find the optimum solution to the problem of satisfying each application.

The combined progress of computer and component technology over the past 25 years has been astounding, with capabilities increasing and costs decreasing by several orders of magnitude. Signs of slowing of the pace of component development are not yet definitively discernible, so rapid advance can be expected to continue in the near future. Fundamental limits appear to be at least two orders of magnitude away. Thus, progress is more likely to be limited by our inability to create new applications than in our ability to produce ever less costly components for the computer. ■

Robert N. Noyce is cofounder and chairman of Intel Corporation. This corporation was founded in 1968 to make large scale integration a reality.

Prior to forming Intel Corporation, he helped found Fairchild Semiconductor Corporation. As research director at Fairchild, he was responsible for the initial development of the silicon mesa and planar transistor lines, later serving as vice president and general manager of the corporation. Before joining Fairchild, he was associated with Shockley Semiconductor Laboratory where he worked in the design and development of silicon transistors.

Noyce's contributions to the development of diffused silicon devices include the first silicon diffused planar transistor, the first monolithic IC's in production, gold doping of semiconductor devices, the first multichip packaging, and PNP double diffused transistors. He holds 16 patents on semiconductor methods, devices and structures, including applications of photoengraving to semiconductors, and diffused-junction isolation for IC's. He also holds the basic patent relating to metal interconnect schemes.

He received his B.A. in physics and mathematics from Grinnell College (Iowa) and his Ph.D. in physical electronics from M.I.T.

Dr. Noyce has been cited by the National Association of Manufacturers in recognition of his contribution to mankind through scientific research, and he has received the Stuart Ballantine Medal from the Franklin Institute. He is a member of the National Academy of Engineering, a Fellow of the IEEE, and a member of the American Physical Society.

1. Arthur C. Clarke, "Communication in the Second Century of the Telephone," *Technology Review* (MIT), Vol. 78, #6 (1976) p. 33.

[From the Washington Post, May 2, 1983]

HIGH TECH: LEAVING HOME—BATTLING TO INNOVATE AND EMULATE: INTEL VERSUS NIPPON ELECTRIC

(By Dan Morgan)

Peering into a microscope at a greatly magnified computer chip one day last August, Peter Stoll of Intel Corp. saw something startingly familiar. In one of the tiny cells, two transistors were disconnected from the rest of the chip, and dangled uselessly in their bed of silicon.

Stoll, 33, a chip designer, recognized the defect as a small last-minute repair job he had performed on Intel's 8086 microprocessor several years earlier. It had worked, correcting the minor flaw in the chip's logic, and the 8086 went on to become phenomenally successful as the "brain" in a wide range of business computers, robots and industrial machinery.

But what startled Stoll was that the chip under the microscope was not Intel's. It was a product of Nippon Electric Co. (NEC) of Tokyo. Stoll concluded that he was looking at a Japanese copy so perfect that it even repeated the small imperfection in the original chip.

Intrigue of that kind in the $13 billion-a-year global market for computer chips has led to U.S. accusations of unfair Japanese practices, ranging from copying to protectionism. Critics of Japan say that its efforts to gain supremacy in computer chips, perhaps the single most important technology of the Information Age, are typical of the methods employed by "Japan Inc."

"We're at war, no doubt about it," said a computer scientist from a large U.S. research laboratory. "If I had money in 'Silicon Valley,' I'd get it out. . . . It's just like any other war zone."

U.S. politicians are in a mood to strike back.

Democratic Reps. Don Edwards and Norman Y. Mineta, from California's so-called Silicon Valley area, have introduced a bill to give copyright protection to chip designs. They say the measure is needed to stop "pirate firms" from "flooding markets with copied designs that undersell the innovating firms."

But some trade specialists caution that there is a Japanese side to this story. For one thing, U.S. companies are holding their own in the competition.

Japan, whose share of the U.S. chip market is well under 10 percent, has made inroads in some kinds of chips, such as memories, that store information. But the United States is dominant in microprocessors, the "computers on a chip" that serve as brains for computers and controls in dishwashers, jet aircraft, missiles, industrial robots, telephone systems, traffic lights and hundreds of other products.

Many experts insist that Japan's progress is not attributable to copying.

"The basis for the Japanese taking an ever larger share of the [chip] market is not transfer of American technology," said a patent attorney for a large U.S. company. "It's Japanese management, equipment and a degree of cooperation between firms that's prohibited in this country."

Even the issues in the Intel-Nippon Electric dispute about alleged copying of the 8086 microprocessor become fuzzier on closer inspection. Intel contended that NEC wrongfully copies the chip's microcode, the set of internal instructions laid out as a pattern of transistors on the chip's memory. Intel counsel Roger Borovoy said the microcode was copyrighted and could not be used without Intel's permission.

Officials from NEC's U.S. sales company acknowledge that the microcode on their chip is identical to that on Intel's, including the flaw engraved onto the original. "If you're not 100 percent 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," said NEC's David Millet, who is in charge of nation-wide marketing of microprocessors.

But NEC officials in Japan and the United States deny that the company did anything wrong, contending that they had a right to produce their own version of the chip under a 1976 agreement allowing both companies to use the other's patents.

NEC officials in this country say the question of whether the microcode can be copyrighted has never been decided in court, and Intel agrees. And they say that NEC even sent Intel a 1979 announcement of NEC's version of the 8086.

The story of the NEC-Intel dispute is representative of the suspicion, tension and, often, grudging admiration that characterize the competition between the two countries. It begins with the markedly different cultures and societies from which the two have emerged.

THE ROOTS OF COMPETITION

Compared with the 84-year-old NEC, Intel is an upstart company, an example of American boldness and nerve that began with a few dozen employes in Santa Clara, Calif., in 1968 and grew into a business with 19,000 employes worldwide,

Intel's stock in trade has been innovation. Since it was founded, the company has spewed out firsts, including the first microprocessor in 1973. A founder, Robert Noyce, is one of the inventors of the integrated circuit, which became a basic component of modern electronics.

Intel is also a sort of corporate melting pot that, like the nation itself, has drawn its brain power from all over the world. Its current president came to America as a refugee from Hungary in 1957; a senior vice president was born in Hungary, and an Israeli, an Italian and a Japanese are credited with helping to develop several new Intel products.

NEC has succeeded in typical Japanese fashion: through dogged determination, aggressive marketing and initial reliance on U.S. technology, including that of Intel.

From the outset, NEC had financial and structural advantages over Intel. While Intel makes more than 80 percent of its income from the sale of chips, NEC is a conglomerate that produces computers, electrical equipment and other products. Chips account for less than 20 percent of its revenue, so a temporary decline in that business can be offset by gains in other products.

As a member of the influential Sumitomo industrial group, NEC could draw on the financial resources of the Sumitomo Bank and on the marketing connections of the Sumitomo trading company. But Intel has depended for its financing on the vagaries of the U.S. stock market and bank loans. For most of the last 10 years, Intel has had to borrow money at much higher interest rates than NEC.

Until the early 1970s, NEC was no match for American chip makers. The U.S. computer chip industry was expanding rapidly, thanks in part to heavy government spending on chips for the Apollo man-on-the-moon space program and the Minuteman intercontinental ballistic missile.

In 1973, computer scientists in Intel's laboratory scored a major break-through with invention of the first microprocessor. This was a watershed not only for Intel, but also in the history of the information industry.

Until then, chips generally had performed only a single task, such as adding, subtracting, multiplying or dividing. Combining those taskes required wiring together several chips on a bulky board. But a single microprocessor chip could perform all those functions. This meant, for example, that one computing chip could run a pocket calculator, shut off a microwave overn, analyze blood or control traffic signals.

It was possible for general-purpose microprocessing chips to replace more expensive, customized ones previously needed by industry. As microprocessors became more sophisticated, they increasingly began to do jobs that previously had required large, cumbersome computers.

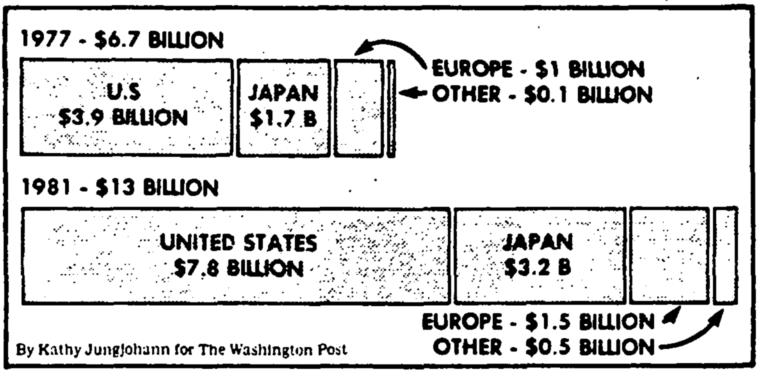
NEC claims to have developed an early microprocessor on its own at about the same time as Intel. This chip, the uCom 4, could handle simple tasks such as operating a pocket calculator. But Japanese officials acknowledge that they have had trouble keeping up with U.S. advances in microprocessors. To do so, Japanese companies have repeatedly relied on U.S. patents and "reverse engineering."

Industry representatives make a distinction between reverse engineering, a generally legitimate practice in which one company's designs are used as a model by another company's engineers, and copying, in which imprints of circuitry are taken by using photographic and lithographic techniques.

In the late 1970s, for example, NEC produced a version of Intel's 8080 microprocessor, the first chip complex enough to handle work-processing programs. A new generation of microprocessors was making possible the era of small, compact personal computers, and Intel was again in the lead.

Tomihiro Matsumara, NEC's senior vice president for research, acknowledged in an interview that NEC attempted to make and sell its own comparable chip, "but we did not succeed." So, he said, NEC engineers analyzed the 8080, then laid out their own "completely different" version, using NEC manufacturing techniques.

WORLD SALES OF COMPUTER CHIPS



SOURCE: DATAQUEST AND SEMICONDUCTOR INDUSTRY ASSOCIATION

Roger Borovoy, Intel's general counsel until he left the company last month, said Intel had no objection because NEC had used the 8080 only as a model and not "copied" it.

Japan, he acknowledged, was becoming an innovator in chips in its own right. Between 1974 and 1977, the government had poured at least $300 million into a research consortium that included NEC and five other companies. "They had come a long way with their own development. They'd attained a status of their own," Borovoy recalled.

Evidence of NEC's progress came in April, 1976, when Intel and NEC signed an agreement that enabled each company to use the other's patents. In the next several years, Intel was to utilize several NEC patents for specialized types of chips.

By the late 1970s, NEC, Hitachi, Fujitsu and Toshiba were grabbing signifiant shares of the world market in memory chips, devices that store information but do not perform the complex tasks of microprocessors. But these companies still had problems with the far more complex microprocessors.

In 1978, a year before NEC completed its version of the 8080, Intel introduced a much more advanced microprocessor, the 8086. It crammed 30,000 transistors onto a quarter-inch-square piece of silicon, producing as much computing power as some 1960s' computers that filled rooms. The 8086 could handle not only word processing but also complex mathematics, and it and comparable microprocessors are being used in most sophisticated personal and business computers, such as IBM's popular personal model.

NEC's representatives recognized that the 8086 gave the United States a decisive edge in silicon brain power. In 1978 they approached Intel about supplying technical aid to produce the 8086 in return for a percentage of the money NEC would get from selling the 8086 in Japan.

But this time, Intel turned NEC down. NEC, in the midst of a U.S. expansion program was preparing to enter the international chip market in a big way. It had just purchased a California computer memory company called Electronic Arrays and was planning a second California facility for making memories and logic circuits.

"We weren't anxious to help our competitor," an Intel official said. Thwarted, NEC decided to go ahead with a version of the 8086 without special help from Intel.

NEC's Matsumara acknowledged that the resulting chip is "interchangeable" with the Intel version, but he strongly denies that it was "copied." Similarly, Robert Kinckley, an attorney for NEC in San Francisco, contends that NEC had a right to reverse-engineer the chip because of the patent cross-licensing agreement of April 1976.

NEC officials said it was no secret that they would produce the 8086. Electronic News reported it and, NEC officials said, they sent a copy of their announcement to Intel and received no protests.

NEC, however, had several problems.

For one thing, the Japanese company apparently had difficulties reproducing a version of the Intel device without American help. It was not until 1980, two years after Intel's 8086 appeared, that NEC's comparable chip was sold in the United States.

There was also the problem of Intel's copyright on the chip's microcode, a sort of brain within a brain. It is the part of the microprocessor that takes electronic commands from a keyboard and tells the rest of the chip's parts what to do with the commands and in what sequence.

Like a video-game cartridge, the microcode is a computer program that has been written by a programmer and then is built into the chip. In a Pac Man videogame, the microcode tells the Pac Man what to do. In a microprocessor, the microcode tells a computer what to do. Although the microcode appears in the 8086 as hardware—a pattern of 10,752 tiny transistors—Intel maintains that it is not a mere piece of electrical circuitry but is "intellectual property" covered by copyright law.

Copyrighting the microcode had seemed to Borovoy a way to protect the company's intellectual effort from infringement. Borovoy said his "knees wouldn't shake" at bringing a lawsuit against a company that copied Intel's microcode.

But Hinckley, NEC's San Francisco attorney, said no cases have been adjudicated establishing any company's copyright claim on such material.

"Copyright is designed to protect works of authorship—artistic works—and we don't think microcode qualifies," he maintained.

Whatever the merits of their respective cases, NEC and Intel reached a settlement on the 8086 in March after several months of negotiations and without litigation. Borovoy, who said he could not discuss details of the settlement, said the agreement would save hundreds of thousands of dollars in court costs.

THE BATTLE FOR MARKET SHARE

But the dispute over the 8086 is seen at Intel as only one chapter in what will undoubtedly be a continuing battle.

"The Japanese see themselves locked in a warlike struggle, determined single-mindedly to reach their objectives by any means, regardless of the impact on the U.S. . . . It's going to be a very, very bloody battle out there, "Intel's Noyce said.

He argued that Japanese tactics have denied American companies the fruits of their innovation, profits that enable them to pour money into creating new technical breakthroughs needed to maintain the U.S. lead.

U.S. studies have accumulated a mass of evidence buttressing Noyce's contention that the Japanese government has shielded local chip companies from U.S. competition while they prepared for an onslaught on traditional U.S. markets. U.S. companies have never been able to capture more than 20 percent of the Japanese chip market even when their technological lead was overwhelming.

Before 1978, only Texas Instruments was permitted to establish a wholly owned manufacturing subsidiary in Japan, and even TI had to share some of its patents with Japanese companies to secure that concession.

Few deny that the Japanese challenge is serious. Japan is running a $250 million trade surplus with the United States in chips. And NEC and Hitachi ranked just behind Motorola and Texas Instruments as world leaders in sales last year.

A detailed study issued in February, 1982, by the congressional Joint Economic Committee warned that the main casualties of the relentless Japanese export drive could be small, innovative Silicon Valley companies. With them out of the running, it warned, Japan would be in a position to beat the United States at innovation.

Some industrial experts say the United States should keep its sense of perspective as it responds to Japan's challenge.

Robert B. Reich of the Kennedy School of Government at Harvard University said Japanese chip companies made headway after 1975 primarily because they plunged ahead while U.S. companies, hard hit by the recession, "stood still."

U.S. companies have recently regained some of their lost share of the world market in memory chips and still have an impressive lead in microprocessors. In typical U.S. fashion, Intel is on the verge of marketing an even more advanced microprocessor, the 80386, which the company claims will be far ahead of anything produced in Japan.

Intel has also announced that it will soon sell the first magnetic, bubble-type memory capable of storing 4 million bits of information, the equivalent of 240 typewritten pages.

"Despite trade barriers and protection and copying, we're still winning, although that's no guarantee for the future,' said Bob Derby, who ran Intel's marketing operations in Japan.

That, free traders say, should be a warning to those in Congress who want to wield the big stick of government retaliation in the computer chip battles with Japan.

CHIPS: A GLOSSARY OF TERMS

Silicon: the hard, gray, lightweight material from which chips ae made. Wafers of silicon are "doped" with impurities in selected places to change electrical properties and affect the path of the current. Lithography is used to imprint tiny wires, or circuits, on a chip's silicon layers.

Transistor: an electrical switch in a chip that can be turned on and off in a controlled way to store or process data.

Integrated circuit: a combination of tansistors. The latest generation contains as many as 100,000.

Memory: a chip that stores information.

Microprocessor: a chip that performs some of the same tasks as a computer; the "brain," or control, in hundreds of pieces of equipment, from car engines to computers.

Microcode: a software program that is the permanent set of instructions on a microprocessor chip.

Bit: A single "on" or "off" signal, a single piece of electronic code. It takes several bits together to represent one letter, punctuation mark or numeral.

C. BY GERALD J. MOSSINGHOFF

U.S. DEPARTMENT OF COMMERCE,
PATENT AND TRADEMARK OFFICE,
Washington, D.C., November 23, 1983.

Hon. ROBERT W. KASTENMEIER,
Chairman, Subcommittee on Courts, Civil Liberties and the Administration of Justice, Committee on the Judiciary, House of Representatives, Washington, D.C.

DEAR. MR. CHAIRMAN: I have been following with great interest efforts to develop an appropriate form of protection for semiconductor chip designs (H.R. 1028). Aware that your Subcommittee may hold hearings in the near future, I wanted to report to you the Administration's position on this important subject.

As you know, the Cabinet Council on Commerce and Trade established a Working Group on Intellectual Property to develop policy options on a number of important intellectual property issues. Recoginizing the importance of the semiconductor industry to the U.S. economy, the Cabinet Council on Commerce and Trade directed the Working Group to consider the need to protect semiconductor chip designs. It found that while the United States dominates this important market, it faces a serious challenge from foreign competition. It also found that the R&D costs for a single complex chip could reach $4 million, while the costs of copying such a chip could be less than $100,000. This constitutes a significant disincentive for creators to invest in this technology.

There are no effective legal means of stopping the copying of chips under existing United States laws. While a patent would protect against the manufacture, use and sale of the electronic circuitry embodied in a semiconductor chip, the circuits actually placed on chips frequently do not satisfy the patentability requirements of being "new, useful and unobvious."

On the basis of these considerations, the Cabinet Council on Commerce and Trade recommended that the Administration endorse protection for the creators of this valuable technology. Specifically, the Cabinet Council on Commerce and Trade recommended the prompt enactment of legislation protecting semiconductor chip designs and that such legislation have the following characteristics:

(a) It should accord prompt, inexpensive protection to original semiconductor chip designs through a registration system without substantive examination.

(b) The protection should grant to the owner of the chip design the exclusive right to copy, for commercial purposes, the chip design, or chip embodied in that design, as well as the exclusive right to distribute such a chip.

(c) The protection should have a relatively short term, e.g., ten years.

(d) As an exception to the exclusive rights, there should be an express right to reverse engineer for the purpose of teaching, analyzing or evaluating the concepts or techniques embodied in the design of the semiconductor chip.

(e) Unless there are overriding circumstances to the contrary, the protection should be prospective from the current time.

The prompt enactment of legislation along these lines would materially assist U.S. industry by providing protection for this valuable and important new technology. I would be pleased to discuss the recommendations of the Cabinet Council on Commerce and Trade in greater detail with you or your staff and to assist the Subcommittee in any way I can.

Sincerely,

GERALD J. MOSSINGHOFF,
Commissioner of Patents and Trademarks.

APPENDIX 3.—SUPPLEMENTAL ARTICLES

VLSI DESIGN AUTOMATIION: AN INTRODUCTION

(By Michael Feuer)

INVITED PAPER

(*Abstract.*—This paper is a brief introduction to the automation of the design of very-large-scale integrated circuits (VLSI). The field of design automation has grown so large in the last twenty years that a complete treatment would require and encyclopedia. What follows, therefore, is only a sketch of the history, state of the art, and current key problems of the aoutomation of VLSI design.)

HISTORY

The history of anything to do with VLSI is almost a contradiction in terms. Until recently, VLSI had always been thought of in the future tense. Integrated circuits (IC's), medium/scale integration (MSI), and large-scale integration (SLI) are historical terms, but not VLSI. Only with the advent of microprocessors with some half/ million transistors on a chip has there been a grudging acceptance that VLSI may indeed have arrived. These acronymic labels are always applied after the fact, but VLSI was resisted longer than most. Extrapolating from the fact that early IC's contained several logic gates, MSI tens, and LSI hundreds, we might expect VLSI circuits to contain thousands of gates. By the same reasoning, today's 32-bit microprocessors would be examples of ULSI (the U for ultra). Maybe we are running out of acronyms and need to conserve. In any case, for this article, a chip with several thousand logic gates or more qualifies as a VLSI chip.

During the 1950's, Texas Instruments, Fairchild Semiconductor, and others developed the photolithographic process for the fabrication of transistors on crystalline silicon. The steps involved in the design of early IC's are still qualitatively the same today. The first step is the definition and optimization of the process by which the devices and interconnections are to be fabricated. The second is the electrical characterization of the circuit elements. These two steps together are sometimes known as technology definition. Third, the user of the technology generates a design (circuit of logic schematic) to be implemented. Fourth, this logical design is reduced to a series of geometric patterns through which materials are to be added or subtracted in the fabrication of the circuit. Finally, a set of test input signal patterns and responses is generated to detect fabrication defects. Testing is an integral feature of IC manufacture because a significant prcentage of chips come off the line with at least one defect. These defects are detected by applying the test patterns to the chip inputs and comparing the output signals to those expected. Defective chips are discarded.

In the 1960's, these five steps were largely manual. Process parameters, such as diffusion temperatures, times, and pressures, and metal line widths and spacings were worked out primarily through trial and error. Yields and electrical properties of the resulting devices were monitored. The process was characterized by a set of electrical and physical design rules for the user of the technology. For digital circuits, the switching characteristics were boiled down to rising and falling delays, fan-out rules, and the like. Physical design rules prescribed widths, spacings, and overlaps required to achieve acceptable yields.

The engineer-user would supply a circuit or logic schematic sketched on a piece of (yellow) paper. The correctness of the circuit could be verified by implementing the same circuit in discrete components ("breadboarding"). An expert layout designer then drew the mask patterns necessary to implement the circuit. The drawings were transferred to a red plastic material called rubylith which was cut away according to the drawing. This step was verified by a careful, independent visual inspection ("eyeballing"). The rubylith pattern was optically reduced to form photolithographic masks. Testing was a manufacturng function. For small circuits, exhaustive functional testing was possible and ac characteristics could be measured.

As time progressed, the number of devices per chip started to double every year (Moore's law, [1]). This increased mask complexity, and in the early 1970's the rubylith patterns began to outgrow the space on laboratory floors. By the late 1960's this method began to give way to numerically controlled optical pattern generating machines. These required digitally encoded geometric patterns, and the layouts were transferred to data tapes by tracing over them with electromechanical digitizers. With the patterns now accessible to computer processing, the visual inspection could be enhanced with design rule checking (DRC) programs which detected shorts and spacing violations. Another advantage was that corrections to the drawing could be made much more easily than to the rubylith cutouts.

The next step was to display the patterns on a CRT screen, and interactive graphic layout was born-an activity almost synonymous with computer-aided design (CAD) for many years. Commercial turnkey graphics systems began to appear in the early 1970's, although large companies developed in-house systems earlier [2]. The power of interactive graphics was most evident for repetitive patterns such as memory arrays or gate arrays, where a set of geometric data called a cell could be replicated thousands of times in different positions and orientations on the array without having to be redrawn.

As the density of IC's increased, the need for circuit simulation programs became critical. Discrete circuits could be probed and monitored at all nodes, but IC's were inaccessible inside the chip. The only way to tell what they were doing internally was through circuit simulation and through effects accessible at output pins. A series of programs was developed in the decade from the mid-1960's to the mid-1970's; CIRCAL, SCEPTRE, ECAP, ASTAP, SPICE, and others [3]. A byproduct of circuit simulation was the availability of the circuit schematic in machine readable form. This network information was entered on punched cards, then through alphanumeric terminals, and lately as drawings on interactive graphics equipment. The network information made possible not only simulation, but also automatic verification that the layout interconnections indeed matched those of the input network.

Because it was impossible to modify a chip to correct a design error, it became important to verify the correctness of the design prior to releasing the chip to manufacturing. Since the simulation of the full analog behavior of large digital circuits became prohibitively expensive, logic simulation with discrete Boolean values became the dominant software verification tool. Switching-level or gate-level simulators evolved through a series of stages ([4] and [5]) until event-driven simulators capable of handling unique delays for several thousand logic blocks became standard tools.

The automation of the layout function began with techniques borrowed from printed circuit board design. Routing algorithms based on work by Lee [6] and Moore [7] were available for finding paths for metal interconnections between pins of logic functions on the chip. A distinction can be made between this sort of automatic design activity and the verification mentioned above: one is synthesis and the other analysis. To facilitate layout, certain constrained design styles such as gate arrays and standard cell arrays were developed in the late 1960's. These led to the invention of the channel router of Hashimoto and Stevens [8], an algorithm unique to IC's. Over the years, routing has become one of the richest areas in design automation in terms of available techniques, and algorithms have been developed to handle the interconnection problem in almost all conceivable situations.

The regularity of standard cells and gate arrays also facilitated the development of automatic placement algorithms of very high quality [9]. The standardization of the size and shape of the units of logic made the placement task more tractable than that of modules on printed circuit boards. Automatic placement and routing together formed a complete automatic layout system [10], [11].

The gate array, or masterslice, was recognized by the systems manufacturers, notably IBM, as a design style which reduced design time while still providing reasonable silicon area utilization compared to free-form layout. It became very important to understand how much routing space was required on a gate array to ensure the automatic layout of almost all designs using the array. Too much routing space reduced the gate count, while too little led to low utilization of available gates. This need led to theoretical work on routing space estimation which found substantial usage and payoff [12].

For designs consisting of large functional units of different internal structure, tools were developed for the automatic generation of PLA macros, register stacks, memory macros, and bit sliced data flow macros [13].

Test generation also soon outgrew the capabilities of manufacturing organizations. Exhaustive tests based on the input-output specifications of the circuit require an astronomical amount of time even for moderately large IC's. An exhaustive test requires that all possible input patterns be applied for each internal state of the circuit. For a static (dc) test this number is two rasied to the number of primary inputs times two raised to the number of internal latches. Even for an early microprocessor, the Intel 8080, an exhaustive test set would contain over 10 patterns; at 1 us per input pattern, the test time would be more than 10 years!

One solution was to save the simulation patterns used to verify the logic design and to appy them during test. Unfortunately, this functional testing did not provide a high level of confidence that other valid input patterns would not uncover defects missed by the test. To estiamte this risk, researchers studied the circuit structure and classified the likely local faults. One model appealing because of its mathematical tractability if nothing else, was the single-struck fault model. With a fault dictionary it was possible to include fault grading into simulation to compute the number of faults which would be uncovered by a set of patterns. The designer could also see which faults would have been missed and could add more patterns to find them. With the single-stuck fault model, test patterns could be automatically generated for combinatorial unit logic using methods such as Roth's celebrated D-algorithm [14].

Extensions of automatic test pattern generation algorithms to sequential circuits met with only limited success up to about 5000 equivalent gates, and it became obvious that the test pattern generators would need more assistance from the logic designers. At least in the case of the large systems manufacturers, special circuitry was added to the chips to increase the ease of generating and applying tests. The best known of these is IBM's Level Sensitive Scan Design (LSSD) [15]. Today testability is recognized as one of the key responsibilities of the logic design. An untestable design, even if otherwise correct, is worthless.

STATE OF THE ART

The status of VSLI design automation is particularly difficult to assess because so much of it is carried on inside large electronics companies on a proprietary basis. Most of these activities are reported in the literature, but, since the systems themselves remain inaccessible, others are forced to develop their own tools or to turn either to unversity sources or to the relatively small vendor design automation industry. This makes for a very uneven of the art.

VLSI design practices vary from the fully integrated highly automatic gate array design systems of the large systems manufacturers to the computer-assisted largely manual methodologies of the designers of high-density custom MOS microprocessors. The following is a composite state-of-the-art design system:

Hardware

A design automation facility usually consists of a family of interactive terminals attached to each other and to a host mainframe computer by a communications network. Alphanumeric terminals are sufficient for messages, status reporting, and job control. A low-cost graphics terminal for logic entry is desirable in each engineer's office. For layout, a high-function color system is most efficient. The advent of inexpensive VLSI memories and microprocessors is revolutionizing the interactive graphics business. The trend has been to supply more and more processing power and memory at the terminals or work stations. The mainframe computer is reserved for long-running jobs such as simulation, test pattern generation, or design rule checking and for maintenance of the central data base. A high-speed plotter is useful for displaying the finished artwork.

Control and Release System

This is software to track design status, to coordinate the contributions of many designers, to control engineering changes and other levels of design, to ensure that updates do not invalidate previous verification steps, and to prepare data in standard form for manufacturing. Data integrity is the key to success in VLSI design. Not only is the number of devices per design staggering, but the design automation process itself produces volumes of intermediate data which must be controlled.

Multimode Hierarchical Data Base

This is not a data base in the usual sense of small interactive transactions. The data needed for automatic processing are rather large specially organized files. These files are related to each other in at least three ways. The first was already mentioned: they may describe different versions or levels of the same thing. The second is that they may describe a different aspect or mode of the same entity. Thus a shifter can have a symbolic form for documentation, a behavioral simulation model, another model for test pattern generation, an outline shape for floor planning purposes, a symbolic track description for automatic routing, detailed polygon mask shapes, and "fractured" rectangle shapes for pattern generation. The data base must maintain consistency among these data modes. These modes contribute to the volume of intermediate data mentioned earlier. The third relationship is hiearchy. The same shifter behavioral model can have an expansion to behavioral models of interconnected latches, which, in turn, can be expanded to simulation models of unit logic elements and, finally, to individual transistors. The associated shapes will display a similar hierarchical structure. In a large systems environment, the hierarchy will extend to all packaging levels as well as the chip. The data base must allow for this multiple nesting of design entities. The trend toward relational data base organization (e.g., Mentor Graphics, Portland, OR) also deserves mention. The advantages claimed are simplicity of use and ease of reorganization for future enhancements without invalidating existing programs. The traditional disadvantage of poor performance seems to be yielding to improved software and hardware techniques.

Unified Interactive User Interface

Any large design system must incorporate tools from various sources. It is important, however, that the user be presented with a consistent, well-designed view of the system. Nomenclature, menu layout, message style, and job submission commands should be consistent. The Bell Laboratories Designer's Workbench is an example of such a system [16]. Redundant data entry should be minimized. Errors, especially simple syntactic errors, should be trapped by the system in real time. Even better is a system to guide the user by presenting only options which cannot produce trivial errors.

Automated Verification

With VLSI this is the key function which a design automation system performs—the avoidance of errors. The beginning of the design process currently is the specification of external system behavior. The verification of system specifications is accomplished through design reviews, emulation on existing hardware, and simulation using general-purpose or specially written simulation systems. The state of the art here is understandably rather uneven. The next phase is the design of the system in terms of functional components. For computer systems, these might be ALU's, PLA's, registers, and busses. The verification of this design is usually done using simulators which contain behavioral models for these functional components. The results are examined for consistency with the system specifications. This comparison is typically not automatic because of the lack of precision of the usual specifications. At this point, the designer should also have a plan for partitioning and packaging the system. On single-chip systems, this is the so-called floor plan. Tools are under development to estimate the shape, area, power consumption, pin requirements, and routability of the partitioned subfunctions, but the verification of the feasibility of a partition or floor plan still depends largely on human judgement. The ensuing refinement steps of detailed logic design can all be verified automatically against the next higher level of design. Static verification of logical equivalence and static timing analysis can take the place of simulation. Where simulation is desired, a mixed-mode simulator capable of combining behavioral, unit logic and possibly switch level, and analog circuit level models is ideal.

Layout verification consists of a comparison with the logic and a check of internal consistency. In a hierarchical system, each level of the layout hierarchy can be checked for spacing violations with the boundaries specified at the next higher level. However, at the lowest levels of design, the verification that a given mask geometry will produce the desired analog devices, and that these, in turn, will perform the desired digital functions is only partly automated today. The usual practice is to limit the design to a specified library of basic structures, to analyze these exhaustively using device analysis and circuit simulation programs, and to generate the appropriate digital models.

Automated Design

Modern design automation systems provide powerful tools for the synthesis of VLSI circuits. Logic entry is necessarily an interactive task. It is supported by intelligent graphic engineering workstations. The automatic generation of detailed unit logic from register transfer logic has met with practical success. PLA minimization programs are in common use. Layout is either computer assisted on high-function color graphic workstations for free-form designs, or highly automated for more constrained design styles such as PLA's, gate arrays, standard cell arrays, and even standard floor plan chips. There is now a trend to mix these design styles on single chips, using automatic generators to produce customized PLA, register, RAM, ROM, and random-control logic macros [13]. Test pattern generation is another sophisticated synthesis problem. The most advanced methodologies use special design rules and additional hardware to subdivide the circuitry into manageable combinatorial sections, or to condense the results of long test sequences, or even to administer pseudo-random test patterns on the chip itself.

Such a composite system does not exist, of course, but each of its components does. Clearly, the development of a state-of-the-art automation capability for fast turnaround VLSI design is a very ambitious undertaking indeed.

PROBLEMS FOR THE FUTURE

Fortunately, there are still problems, or, rather, opportunities for creative work. How does one manage the complexity of VLSI design? What happens when computer runs exceed weeks? When tester times exceed hours?

The complexity of VLSI designs has grown to the extent that there are substantial doubts about the designers' ability to keep up with process capability. The implication is that future chips will be designed inefficiently in terms of silicon utilization or performance because of lack of time and design resources. The phrase "silicon is cheap" has always had a certain irony about it, but we may actually be coming to the point that silicon utilization is less important than design time.

While the problems are serious, they are not insurmountable. Clearly some very spectacular chips are being designed. 32-bit microprocessors such as the Intel iapx432, the Bell Laboratories BELMAC, and Hewlett-Packard's 32-bit microprocessor chip set [17] are all near the limit of fabrication technology. There is no reason to expect the next generation of microprocessors to leave any unused silicon either. Even so, these projects are costly (50–100 person-years) and therefore rare. If VLSI were as simple to deal with as modules on wire-wrap boards, many more products would appear.

The problem of handling complexity has come up in other disciplines, notably software engineering, and a variety of promising techniques have been proposed. Prof. C. Sequin has a very interesting discussion of this subject elsewhere in this issue. One technique for dealing with complexity has been to use regular structures such as PLA's rather than try to squeeze out every square micrometer through local optimization. This approach, advocated by C. Mead of Caltech [18], has broad implications. How does one obtain a library of useful regular structures or macros to include in one's VLSI design? To be useful to someone other than the designer, a macro must be general, well documented, and configurable to other technology ground rules and to other system environments. Such macros would necessarily be encoded primarily as programs and only secondarily as pictures. This again is a feature of the Caltech approach. To be useful, each of these macro generation programs should be accompanied by a simulation model as well. All this implies a level of interface standardization which has yet to be achieved. Thus one challenge is the invention and development of commercially available VLSI macro generators and the creation of an environment to facilitate their transfer.

A closely related challenge has to do with interactive graphics. We need to develop graphic techniques for specifying not only pictures, but families of pictures with given relationships among their components. Procedural design or algorithmic macro generation is inherently a problem of expressing shapes and their relationships, yet we must still use programming languages which are patterned on speech, rather than use the seemingly more natural medium of interactive graphics. Why can these programs not be specified by diagrams which express the number of repetitions of a shape in two dimensions, the required clearances and overlaps of related shapes, the fact that some can be extended as necessary, and so on? We can generate families of pictures from programs; how can we generate programs from pictures?

Reusing standard macros is one way to deal with design complexity. Another is to automate the design process so that the designer deals only with high-level entities and the machine handles all the details of converting and optimizing the design. In layout, as was previously mentioned, there are automatic design algorithms for gate arrays and standard cells. For such chips the time spent in logic design far exceeds the time spent in layout. There is a need for automated techniques for converting high-level functional descriptions to lower level logic suitable for implementation. This logic synthesis task has always been thought of as impractical for large networks, but recent progress in optimization by local transforms [19] holds out the promise of a solution. The generation of functional chips from high-level functional specifications, whether for gate arrays with unit logic or for standard floor-plan MOS microprocessors, would be a true "silicon compiler" and a worthwhile goal.

The issue of simulation and test pattern generation run times is still a very real one. Despite the advances in static verification and other proofs of correctness, there is no better way to verify the initial specifications of a system than through real-time emulation or simulation. The designer often does not understand all the capabilities of a structure which he creates. A period of "playing around" with the design is required. Simulations of VLSI systems running even trivial test programs are almost prohibitively expensive. A potential solution is the hardware simulation engine—a large array of processors and memories tied together with a high-speed communications switching network. It can handle the number-crunching simulation operation at speeds thousands of times greater than a standard serial computer. These engines might have been included earlier in this article as part of the state of the art, but there are still too few of them in use, and their effectiveness in a production environment is undocumented. The simulation problem remains a major challenge.

Test pattern generation speed can also be significantly enhanced by using the same or similar engines. However, there is also the problem of applying the tests in fabrication. This is still a sequential process, carried out by expensive test equipment. One way to cut down both test pattern generation time and testing expense is to have the VLSI chip carry its own built-in tester. While self-test and other hardware-assisted testing techniques impose penalties on silicon utilization, the tradeoff appears favorable. In any case, if there are any fears about designers' ability to use everything the process people can provide, this added testing requirement should allay them.

The most exciting challenge of VLSI design is in the area of applications. There is enough capability today, both in technology and in design techniques, to create radically new electronic systems. In the 1950's computer experts were fond of speculating on the structure of the brain, on robots, and on automatic language translation. Then the IC revolution occurred, and most practical people turned to remapping Von Neumann's computer from one technology to the next.

Some of these questions are being revisited today. Indeed, the ogic simulation engine discussed earlier is an example of a step in this direction. It uses the power of many concurrent processors to model the concurrent events in a digital system. The recognition and translation of speech are also composed of many inherently concurrent activities. The efficient searching of a data base is another example of inherently concurrent processing.

The technology exists to produce vast arrays of processing and memory elements. What is not clear is how to have them communicate with each other. The interconnect capability of integrated circuits is hopelessly outclassed by that of biological systems. The easiest arrays to build have interconnections only among nearest neighbors. When it is necessary for each processor to be able to communicate with any other, as it is in the logic simulation engine, the communication network quickly becomes a bottleneck.

Design automation can only play a supporting role in the process of creating these new concurrent systems. Improvements in logic description languages and in simulation techniques will help researchers to study the properties of alternate architectures. On the other hand, these unconventional new VLSI systems will have profound effects on design automation techniques. Programming general-purpose multiprocessor computer systems will require new techniques, but the resulting code should execute thousands of times faster than on uniprocessors. Compliers may begin to understand subsets of natural language. Spoken input and output may develop into an important medium of communication between man and machine.

Design automation will be transformed by the VLSI products which it will have helped create.

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INTELLECTUAL PROPERTY PROTECTION AND INTEGRATED CIRCUIT MASKS

John Craig Oxman

I. INTRODUCTION

The foundation of the electronic industry in the United States today lies in the production of integrated circuits.[1] Developed in the late 1950s,[2] the integrated circuit (IC)[3] has come to dominate all but a few esoteric applications in electronics, and it can safely be said that ICs are responsible for the widespread availability and low cost of products and circuit functions which only a few years ago would have been prohibitively costly or technically infeasible.[4]

ICs are made today by a process substantially similar to the Iso-Planar® process developed by Fairchild Semiconductor as an extension

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[1]This is apparent to anyone who reads industry publications, including ELECTONIC DESIGN, the IEEE SPECTRUM and THE JOURNAL OF ELECTRON DEVICES. For a good introductory discussion, see *Microelectronics*, SCIENTIFIC AMERICAN, Sept. 1977.

The total sales of electric and electronic equipment was $73.9 billion in 1976. U.S. DEP'T OF COMMERCE, ANNUAL SURVEY OF MANUFACTURES 1976 at 4 (1978). Integrated circuits alone accounted for $2.5 billion of this, or 3.4%. ICs now account for 25% of all electronic component shipments, and by 1983 will account for 35% of all such shipments. U.S. DEP'T OF COMMERCE, 1979 U.S. INDUSTRIAL OUTLOOK 282-84 (1978).

[2] The integrated circuit was invented in 1958 by Jack Kilby of Texas Instruments, Inc. *See* WHO'S WHO IN AMERICA 1978.

[3]The term "integrated circuit" denotes a collection of electronic parts including, but not limited to, transistors, resistors, capacitors, controlled rectifiers, diodes, etc., which are physically all on one, or perhaps more, semiconductor substrates and which together perform a circuit function, such as amplification.

[4]For example, today one thinks nothing of buying for $5 a four-function electronic calculator made by any of a myriad of manufacturers. In April, 1971, only one company (Sharp) marketed such calculators which then cost $345. DUN'S REV., Sept. 1972, at 89.

of the original planar transistor process.[5] This process involves the use of "masks" which, when employed as described below, define patterns on the IC. It is the interrelationship of the superimposed patterns of several masks which enable a circuit to be created. The optimal juxtaposition of these patterns is crucial both to the performance of the circuit and to the ultimate economy of the IC. As a result, IC makers invest substantially in the development of optimal masks.

Originally, ICs were relatively small and unsophisticated containing perhaps a half dozen transistors[6] and a few resistors. The effort invested in the creation of a set of masks for such a circuit, while not trivial, was not so substantial or difficult that a prospective manufacturer of the circuit would not make a mask set suited to his own production process. However, times have changed. Today, it is not unusual for manufacturers to vend ICs with more than 50,000 transistors on the chip.[7] The level of complexity is so great that it now has become far less economical for manufacturers to create mask sets.

In many cases, manufacturers will make or want to make ICs which are directly interchangeable with counterparts manufactured by competitors. There are many reasons for this. First, many of the interchangeable ICs are circuit functions commonly used which a manufacturer of a full line of ICs would want to produce.[8] Second, in other cases the interchangeable IC may be part of a system of ICs designed to be used together.[9] A manufacturer in this way has immediate access to a market of system users interested in less costly components. It can also ease a manufacturer's entry into the "system" market, allowing him to test the water without having to take the plunge. Third, the manufacturer may have several improvements in mind which would make his IC superior to all other interchangeable counterparts. Since

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[5]J. A. Hoerni, Planar Silicon Transistors and Diodes, IRE Electron Devices Meeting, Washington, D.C. (1960). Hoerni, a Fairchild employee, assigned his patent No. 3,025,589 on the planar process to Fairchild.

[6]The transistor is the basic gain element of solid state electronics. Today the term transistor can mean any of several structures, such as bipolar, field effect, insulated gate field effect, to name a few. Because a transistor can be used both as an amplifier and as a switch it is used both in analog and digital circuits.

[7]For example, a 64 K static random access memory. *See Microelectronics*, SCIENTIFIC AMERICAN, Sept. 1977.

[8]Customers like most humans, tend to be lazy. If they can satisfy all their needs from one supplier, they will do so, even if another supplier offers a slightly lower price. This is not only due to laziness but to lack of inexpensive information (which itself is a function of small price differentials), desire to maintain goodwill, and past success with the IC maker's products.

[9]E.g., Microprocessor systems. These systems generally consist of chip "sets" which include μP (microprocessor) chip, an I/O (input/output) chip, memory chips, and other support chips. The system chips form a computer when properly interconnected.

the IC is by design interchangeable, the manufacturer does not have to convince the user to redesign his complete product.[10] Finally, in many applications the user, usually the government, requires that any IC in any design be "second-sourced." Second-sourcing increases the likelihood that the needed IC will be available in spite of market and worldly uncertainties. Hence a would-be manufacturer interested in this market may actively solicit other manufacturers to produce his IC so he will be second-sourced.

For all these reasons, manufacturers generally would like to be able to offer at least an equivalent to any competitor's circuit. Because the cost of developing the masks needed to produce the IC increases with circuit complexity, there is incentive to copy the competitor's masks, thus avoiding the substantial development costs. Obviously, the manufacturer who has invested substantial sums in mask development is loath to see his product duplicated at a lower price within weeks of the product's introduction to the market. Yet with easily obtainable and relatively inexpensive equipment, an unscrupulous IC manufacturer can copy the mask design of his industrious competitor. The mask pirate will reap much gain from the sale of a product which cost him essentially nothing to develop. This situation is intolerable for the one who did incur the necessary development costs. It will reduce his profitability to the point that he no longer will spend any money on new IC development. In the end all will suffer as manufacturers have less incentive to introduce new products to the market.

Up to the present no IC company has brought an action against a mask-pirating competitor. Instances of mask piracy do exist, however,[11] and because of the rapid rate at which complexity of ICs is growing, it is only a matter of time until IC manufacturers generally will feel the pressure of competition from mask pirates. Hence any legal means of preventing such piracy is of great practical interest to such companies. The legal problems are interesting as they put in bold relief the inherent limitations of our system of intellectual property protection.

This paper will describe generally the IC process and explore and

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[10]This is the concept of "sockets." A "socket," to an IC company, is a need or potential need of a customer for the IC company's part. For example, if Company A makes high-speed comparators and these have been designed into equipment by users, then Company B, by producing an interchangeable high-speed comparator, will compete, literally, for the "sockets" in which Company A's comparators would otherwise reside. Although a multitude of IC companies exist, only a few make each part. What appears to be an economist's classic purely competitive market with many producers is not the case with regard to any specific product.

[11]Conversation with Roger S. Borovoy, Vice President and General Counsel, Intel Corporation, December 7, 1978.

assess three kinds of protection which conceivably could be used to prevent piracy of IC masks. It will examine the needs of the IC industry and the level of protection which should be accorded IC masks, in view of the overall social considerations.

II. THE IC PROCESS

The integrated circuit process most widely used today is silicon-based.[12] Basically, the electrical properties of pure silicon can be varied widely by the minute and controlled introduction of impurities into the silicon.[13] By juxtaposing regions of varying impurity in the silicon, different circuit elements, such as transistors,[14] resistors,[15] and capacitors,[16] can be created. The process uses the aforementioned masks in conjunction with a photoresist[17] applied to the silicon such that one can control exactly the location, quantity, and type of each impurity[18] used in the process. By successive application of impurities in the mask defined areas, the circuit is created. This process is outlined below in Figure 1.[19] In Step 1, the engineer designs a circuit from the basic idea and specifications of the circuit. In Step 2, this circuit is reduced to an optical reticle. Such optical reticles are generally on a scale 200 to 500 times the actual size of the final circuit[20] and are made of thin colored mylar sheet adhesively bonded to thicker, clear mylar sheet. Steps 3 to 5 depict the reduction of the mylar optical reticle into a working mask. The reticle is photoreduced to a master mask; the master mask in turn is photoreduced in size to make the working mask.

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[12] *See generally* S. GANDHI, THE THEORY AND PRACTICE OF MICROELECTRONICS (1968).

[13] The introduction of such impurities is called "doping." Minute quantities of dopant can cause dramatic changes in electrical characteristics such as resistance. For example, if we dope pure silicon at room temperature with antimony in the amount of only one antimony atom for every one hundred million silicon atoms, the resistivity will decrease by a factor of 100,000. *See* B. STREETMAN, SOLID STATE ELECTRONIC DEVICES 70 (1972).

[14] *See* note 6 *supra*.

[15] A resistor in an element which obeys Ohm's Law over a wide range of operating conditions.

[16] A capacitor is an element which stores electrical energy in the form of an electric field. An ideal capacitor does not dissipate any energy as a resistor does.

[17] Photoresist is a light-sensitive chemical which can be dissolved by its associated developer if it has not been exposed to light. If it has been exposed to light it cannot be dissolved. Photoresist also has an associated etch which will dissolve the exposed photoresist.

[18] Impurities (called "dopants" in the trade) commonly used include boron, phosphorous, antimony and arsenic.

[19] IEEE SPECTRUM, Dec. 1977, at 35.

[20] The largest commercially available ICs today are memory chips roughly one quarter inch on a side.

The working mask is created by a step-and-repeat camera which not only performs the second photoreduction but also creates an array of many identical circuit patterns on the working mask. The working masks are fabricated on a glass substrate; the areas which were colored on the optical reticle appear black on the working mask and are opaque. New working masks are reproduced from the master mask as old ones wear out.

It is in Step 7 that the actual silicon processing begins. Silicon is grown in a very pure, almost monocrystalline "boule," then sliced into thin wafers and polished. The wafer is oxydized and photoresist applied. Steps 12 to 15 show the circuit fabrication. The mask is placed on the photosensitized silicon wafer and the assembly is exposed to ultraviolet (UV) light. The wafer is then treated with developer. Where the mask has permitted light to strike the wafer, the photoresist is "hardened" (polymerized) and will not be "developed." However, the unexposed "soft" areas will be etched away, as will the underlying oxide layer. This leaves bare silicon exposed. The wafer is treated with an etch which removes the hardened photoresist and then placed in a diffusion oven. Impurities placed in the oven will diffuse by random motion into the silicon through the openings. By iterating this procedure (Step 16), several layers build up. Finally, a metal is applied in a pattern which interconnects the various circuit elements and the wafer is ready to be tested (Step 17), broken into individual circuits ("chips" or "dice") (Step 18), packaged (Step 19), tested again, and shipped (Step 20).[21]

This process is used to produce a wide variety of circuits. Both analog [22] and digital[23] circuits are manufactured using processes virtually identical to the one described. Further, human creativity enters

[21]This process is identical to contact printing of negatives in photography.

[22]Analog circuits are circuits designed to perform analog functions, such as amplification, integration, differentiation, comparison, and function generation. In an analog world, relative magnitudes matter greatly. An analog world is comprised of states of existence each of which is immediately adjacent to another state of existence—there are no discontinuities. (Although some function generators operate in a piecewise—continuous fashion, this does not interfere with the basic distinction drawn here.)

[23]Digital circuits are designed to perform digital functions. Most digital circuits made today operate according to the laws of Boolean algebra, which assumes a universe wherein every variable attains only two states (it is convenient to think of these states as on and off, or yes and no). Because of the uniformity of the underlying algebra and the relative insensitivity needed to resolve only to states of existence, digital circuits can be large, modular, and cheaply made.

Digital circuits could be organized around another algebra, say an algebra where every variable attains one of only three states. This immediately places much greater sensitivity requirements on the circuits. An analog circuit can be thought of as the limiting case of a digital circuit operating under an algebra where any variable can attain an infinity of states.

the process only twice: once at the circuit or process design stage (Step 1), and again at the layout of the optical reticle (Step 2). Thereafter, the process is virtually insensitive to individual circuit variation.[24]

The misappropriation of the mask designs does not require access to either the optical reticle, the master masks, or even the working masks. Instead, the chip itself can be "disassembled" into its constituent masks through the use of photomicrography.[25] Using either special filters or chemical etch,[26] one can reproduce the entire mask set of a chip quickly and economically.[27]

III. BASIC MODES OF PROTECTION OF IC MASKS

IC manufacturers are concerned that the rewards of their substantial investments in chip development not be misappropriated.[28] They are especially concerned that their new products not be preempted or even quickly followed on the market. There is (and should be) nothing an IC maker can do to present another IC maker from simultaneously marketing a similar IC the circuit of which is not patented. However, piracy of another IC maker's developed mask set to accomplish this purpose is another matter. Since one who possesses the mask set and a few pieces of needed equipment can produce the chip easily, protection must center on the mask set. Specifically, the desire is to protect the layout of the circuit from misappropriation by either exact microphotoreproduction or copying sufficient to constitute an infringement under copyright principles.

The legal modes of protection which could possibly afford IC makers some protection fall into two basic categories: nonstatutory and

[24]Indeed, in designing the remainder of the process, a uniform process is desirable both to enhance throughput and to minimize operator error.

[25]This is called "reverse engineering." It is generally the disassembly of an object lawfully acquired into its component parts to learn its principles or specifications. Usually, this is followed by incorporation of these principles or specifications into one's own process or product. However, in this case, there is not the step of generalizing the principles and applying them to one's own effort; rather it is plain copying.

[26]The basic equipment needed for this operation is a microscope with a camera mounted to take picture, and a set of chemical baths to remove one-by-one the applied layers so that the next underlying layer becomes visible.

[27]According to one industry executive, reproduction of a mask set costs $20,000 to $30,000 and takes about 30 days (in Japan). National Commission on New Technological Uses of Copyrighted Works (CONTU), Transcript of Meeting Number 19, January 12, 1978, at 40, (testimony of Roger S. Borovoy, Vice-President and General Counsel, Intel Corporation) [hereinafter cited as CONTU Meeting 19].

[28]*Id.*

statutory. Nonstatutory protection includes the law of unfair competition and of trade secret. Statutory protection resides in the law of patent and copyright. While chances are remote that any protection exists under the current statutory and judicial setting, each mode raises issues to be considered should protection be given. For reasons which will become apparent, it is the law of copyright which is best suited, and has the greatest chance of success to protect integrated circuits.

A. Nonstatutory Protection

1. *Unfair competition*

The law of unfair competition is a common law tort doctrine[29] designed to protect business interests from infringement or injury due to unethical or unfair practice.[30] The common law of unfair competition has fallen on hard times however, as evidenced by the *Second Restatement of Torts*.[31] The *Second Restatement* no longer includes such topics from the original *Restatement*[32] as "passing off," infringement of trademark or trade name, imitation of appearance of goods, false advertising, misrepresentation and trade secret.[33] The *Introductory Note to Division Nine of the Second Restatement* relates some of the reasons:

> The rules relating to liability for harm caused by unfair trade practices developed doctrinally from established principles in the Law of Torts, and for this reason the decision was made that it was appropriate to include these legal areas in the Restatement of Torts despite the fact that the fields of Unfair Competition and Trade Regulation were rapidly developing into independent bodies of law with diminishing reliance upon the traditional principles of Tort law. In the more than 40 years since that decision was initially made, the influence of Tort law has continued to decrease, so that it is now largely of historical interest and the Law of Unfair Competition and Trade Regulation is no more dependent on Tort Law than it is on many other general fields of the law and upon broad statutory developments, particularly at the federal level.[34]

The increased infusion of legislation, especially federal, has reduced the importance of the common law of unfair competition. How-

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[29]*See* W. PROSSER, LAW OF TORTS 956-67 (4th ed. 1971).

[30]"Included in the list of proscribed practices are defamation of the competitor, disparagement of his goods and his business methods, intimidation, harassing, and annoyance of his customers or his employees, obstruction of the means of access to his place of business, threats of groundless suits, commercial bribery, and inducing employees to commit sabotage." *Id.*

[31]RESTATEMENT (SECOND) OF TORTS (1979).

[32]RESTATEMENT OF TORTS (1939).

[33]*See generally* RESTATEMENT OF TORTS §§ 711-761 (1939).

[34]RESTATEMENT (SECOND) OF TORTS, Division 9, Introductory Note (1979).

ever, the most serious blow came from two companion decisions of the Supreme Court. In *Sears, Roebuck & Co. v. Stiffel Co.*[35] and *Compco Corp. v. Day-Bright Lighting, Inc.*[36] the defendants each produced lamps substantially similar to plaintiffs'. Plaintiffs alleged both patent infringement and unfair competition (under the doctrine of "palming-off" or "passing off"). The patents in both cases were found invalid.[37] The issue then became "whether a State's unfair competition law can, consistently with the federal patent laws, impose liability for or prohibit the copyrighting of an article which is protected by neither a federal patent nor a copyright."[38] The court in *Sears* discussed considerations of federal supremacy,[39] of national uniformity of protection [40] and of the basic policies of the patent system:[41]

> [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 on 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.[42]

The Court found that federal law preempted state law, and also found that the law of unfair competition interfered with the policy of granting a limited monopoly for true inventions in return for full disclosure:

> To allow a State by use of its law of unfair competition to prevent the 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.[43]

The Court in *Compco* summarized its holding accordingly:

> [W]hen an article is unprotected by a patent or a copyright, state law may not forbid others to copy that article. To forbid copying would interfere

[35] 376 U.S. 225, *reh. denied*, 376 U.S. 973 (1964).
[36] 376 U.S. 234, *reh, denied*, 377 U.S. 913 (1964).
[37] Sears, Roebuck & Co. v. Stiffel Co., 376 U.S. 225, 227 (1964); Compco Corp. v. Day-Bright Lighting, Inc., 376 U.S. 234, 236 (1964).
[38] 376 U.S. 225 (1964).
[39] 376 U.S. at 230-31.
[40] 376 U.S. at 231 n.7.
[41] *Id.*
[42] 376 U.S. at 230-31.
[43] 376 U.S. at 231.

with the federal policy, found in Art. I, § 8, cl. 8 of the Constitution and in the implementing federal statutes, of allowing free access to copy whatever the federal patent and copyright laws leave in the public domain.[44]

It appeared in the *Sears-Compco* decision that the Court intended to preempt all state laws of unfair competition by allowing copying of "whatever the federal patent and copyright laws leave in the public domain."[45] However, the Court subsequently retrenched in the landmark case of *Goldstein v. California*,[46] where it upheld California's tape antipiracy law.[47] In *Goldstein* the petitioner purchased tapes or records of popular artists' performances and rerecorded the performances onto blank tapes. Labels were attached and the tapes sold; at no time was petitioner authorized by the artists or recording companies to copy the performance. Petitioner argued that since at the time of the copying the records were not protected under the federal copyright statute,[48] the *Sears-Compco* doctrine affirmatively protected the right to copy the recordings. The Court noted that the scope of "writings" in section 4 of the Copyright Law[49] was not coextensive with the scope of "writings" in the Constitution,[50] and is not properly so interpreted. The Court then proceeded to modify the basic *Sears-Compco* holding and to exclude the law of copyright from that holding by rephrasing the *Sears-Compco* issue as "weather a State could, under principles of a state unfair competition law, preclude the copying of *mechanical* configurations which did not possess the qualities required for the granting of a federal design or mechanical *patent*."[51] [emphasis added] There was no such specificity in *Sears* or *Compco* that the decisions there applied

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[44]376 U.S. 234, 237 (1964).

[45]*Id.*

[46]412 U.S. 546 (1973).

[47]The California tape antipiracy law provides in pertinent part: "(a) Every person is guilty of a misdemeanor who: (1) knowingly and willfully transfer or causes to be transferred any sounds recorded on a phonograph record, . . . tape, . . . or other article on which sounds are recorded, with intent to sell or cause to be sold, . . . such article on which such sounds are so transferred, without the consent of the owner." CAL. PENAL CODE § 653(h)(West).

[48]17 U.S.C. §§ 1-216 (1970). In 1971, Pub. L. No. 92-140, 85 Stat. 391, amended the federal copyright laws to protect such recordings "fixed, published, and copyrighted" on and after February 15, 1972, and before January 1, 1975. The infringing recordings of *Goldstein* were made before February 15, 1972.

[49]17 U.S.C. § 4 (1970): "The works for which copyright may be secured under this title shall include all the writings of an author."

[50]U.S. CONST. art. I, § 8, cl. 8: "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. . . ."

[51]412 U.S. 546, 569 (1973).

only to patent and not to copyright. The *Goldstein* Court pursued this line as it sliced the onion yet thinner:

> In regard to mechanical configurations, Congress had balanced the need to encourage innovation and originality of invention against the need to insure competition in the sale of identical or substantially identical products. The standards established for granting federal patent protection to machines thus indicated not only which articles in this particular category Congress wished to protect, but which configurations it wished to remain free. The application of state law in these cases to prevent the copying of articles which did not meet the requirements for federal protection disturbed the careful balance which Congress had drawn and thereby necessarily gave way under the Supremacy Clause of the Constitution. No comparable conflict between state law and federal law arises in the case of recording 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.[52]

The passage above is obscure. First, what is meant by the particular categories Congress wished to protect? Did not the copyright law also list categories to be protected and to be excluded from protection?[53] Did not Congress draw a balance between encouragement of new ideas and competition by requiring only "originality" in copyright? And finally, if one were to apply the Court's dictum to a *Sears-Compco* situation, would not one arrive at an opposite result? Since Congress did not act or draw a balance in the area of unfair competition and since the lamps in *Sears-Compco* were not covered by the federal patent law (the patents were invalidated), no reason exists why a state should not act.

Regardless of whether the law of unfair competition is preempted today by either patent or copyright law, it is doubtful that it would be a useful tool to prevent IC reticle or mask piracy. It is rare in the IC industry for one manufacturer to "pass-off" his product as another's; while several manufacturers usually make each type of IC, each advertises it as his own. In fact, many manufacturers buy dice from others, then package the dice and sell the IC under their own name. This is clearly not illegal. It is doubtful that one who merely copied another's design and produced ICs from it instead of purchasing dice could be held to have infringed a trademark or trade name,[54] imitated the ap-

[52] 412 U.S. at 569-70.

[53] Under the Court's interpretation that statutory "writings" included less than constitutional "writings" and the principle *expressio unius est exclusio alterius.*

[54] Defense: The "infringer's" company name and trademark could be used on the mask and package.

pearance of goods,[55] falsely advertised,[56] "passed-off"[57] or misrepresented for IC.[58] In any case, the shadow which the *Sears-Compco* decisions has cast on state unfair competition law makes it risky for an IC manufacturer to rely on this type of protection.

2. *Trade Secret*

The law of trade secrets is a branch of the common law of unfair competition.[59] A generally accepted definition of a trade secret is given in the *Restatement of Torts*:

> A trade secret may consist of a formula, device or compilation of information which is used in one's business and gives him an opportunity to gain an advantage over his competitors who do not know or use it. It may be a formula for a chemical compound, a process of manufacturing treating or preserving material, a pattern for a machine or other device, or a list of customers.[60]

It appears that IC masks would fall in the category of "a pattern for a machine or other device." Liability for disclosure of trade secrets is as follows:

> One who discloses or uses another's trade secret, without a privilege to do so, is liable to the other if—
> a. he discovered the secret by improper means, or
> b. his disclosure or use constitutes a breach of confidence reposed on him by the other in disclosing the secret to him, or
> c. he learned the secret from a third person with notice of the fact, that it was secret and that the third person discovered it by improper means or that the third person's disclosure of it was otherwise a breach of his duty to the other, or he learned the secret with notice of the fact that it was a secret and that its disclosure was made to him by mistake.[61]

Secrecy is the crucial element. One cannot divulge the secret freely

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[55]Defense: The packaged IC's appearance is that of its package and chip which have infringer's characteristic masks.

[56]Defense: The IC was advertised as the infringer's (not the infringed's) product and was correctly advertised as to specifications.

[57]Defense: *Sears-Compco* prohibits application of state unfair competition law to unpatentable items which are "passed-off."

[58]Defense: The infringer advertised the IC as his own and correctly advertised its specifications.

[59]*See* W. PROSSER, LAW OF TORTS 957 (4th ed. 1971). *See generally* R. ELLIS, TRADE SECRETS (1953).

[60]RESTATEMENT OF TORTS § 757, Comment (b)(1939).

[61]RESTATEMENT OF TORTS § 757 (1939).

and then claim infringement. The secrecy does not have to be absolute; it must only be substantial in such that it is difficult for outsiders to acquire the secret.[62] There is no need for originality or innovation[63] and no formal mechanisms need be used to commence protection. The secret is protected if the protector treats it as such from its inception.[64] A trade secret is not property per se. Liability rests instead on a breach of a general duty of good faith imposed by contract, confidence or propriety.[65] Usually, the holder of the secret will license it to others under contract wherein the licensee promises not to divulge the secret. The protection of a trade secret is theoretically infinite in duration.[66] However, once the secret is published or disclosed to the public, protection is lost. The infringed party will not have recourse against members of the public who then use the secret.[67] He will only have recourse,

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[62]55 AM. JUR. 2d *Monopolies, Restraints of Trade, and Unfair Trade Practices* § 702 (1972).

[63]RESTATEMENT OF TORTS § 757, Comment (a) at 5, Comment (b) at 7, 8 (1939). However, the fact that the secret is valued usually implies some novelty. *See* Comment, *The Stiffel Doctrine and the Law of Trade Secrets*, 62 NW. U.L. REV. 956, 969 (1968).

[64]*See, e.g.*, DuPont Power Co. v. Masland, 244 U.S. 100 (1917).

[65]RESTATEMENT OF TORTS § 757, Comment (a)(1939):

> The suggestion that one has a right to exclude others from the use of his trade secret because he has a right of property in the idea has been frequently advanced and rejected. The theory that has prevailed is that the protection is afforded only by a general duty of good faith and that the liability rests upon a breach of this duty; that is, breach of contract, abuse of confidence or impropriety in the method of ascertaining the secret.

See also DuPont Power Co. v. Masland, 244 U.S. 100 (1917), where Justice Holmes said:

> The word property as applied to trade-marks and trade secrets is an unanalyzed expression of certain secondary consequences of the primary fact that the law makes some rudimentary requirements of good faith. Whether the plaintiffs have any valuable secret or not the defendant knows the facts, whatever they are, through a special confidence he accepted. The property may be denied but the confidence cannot be. Therefore the starting point for the present matter is not property or due process of law but that the defendant stood in confidential relations with the plaintiffs, or one of them. 244 U.S. at 102.

[66]RESTATEMENT OF TORTS § 757, Comment (a)(1939).

[67]*Id.*

> One who discovers another's trade secret properly, as, for example, by inspection or analysis of the commercial product embodying the secret, or by independent invention, or by gift or purchase from the owner, is free to disclose it or use it in his own business without liability to the owner. *Id.*

The Supreme Court has noted the limits of trade secret:

> A trade secret law, however, does not 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 derive the process which aided in its de-

if at all, against the disclosing party.[68] The public, on the other hand, can be prevented from ever knowing the secret. The valuable policy behind patents and copyrights of offering the creator a limited monopoly in exchange for his idea is not fulfilled. The competing interests of the creator and the public are not well balanced—either the creator keeps the secret intact and the public uninformed, or the secret is lost to the public domain forever and the creator is without remedy.[69]

The doctrine of trade secret was placed in considerable doubt by the *Sears-Compco* decisions[70] of the Supreme Court. Although the *Sears-Compco* cases did not involve trade secrets, they did involve the state common law of unfair competition, of which the law of trade secrets is a branch.[71] The question of survival of the trade secret doctrine finally was[72] resolved in *Kewanee Oil Co. v. Bicron Corp.*[73] *Kewanee* involved a secret process to grow large synthetic crystals developed by the Harshaw Chemical Company. Several employees, each of whom had at a previous time executed an agreement not to disclose Harshaw's trade secrets, left Harshaw's employ and joined Bicron. Bicron soon produced large crystals too. The Supreme Court reversed

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velopment or manufacture. Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 476 (1974).

[68]The liability of the disclosing party is predicted on unlawful or unethical appropriation, breach of contractual agreement, or breach of confidence. *See* note 55 *supra*. *See also* Bender, *Trade Secret Protection of Software*, 38 GEO. WASH. L. REV. 903, 909 (1970). To sustain his cause of action, the infringed party must show that the secret existed and had value to his business, that he was entitled to use it, and that the infringer acquired the secret by unlawful or unethical means. 55 AM. JUR. 2d *Monopolies, Restraints of Trade, and Unfair Trade Practices* § 704 (1972).

[69]*See* Note, *Protection of Computer Software—A Hard Problem*, 26 DRAKE L. REV. 180, 184 (1976).

[70]Sears, Roebuck & Co. v. Stiffel Co., 376 U.S. 225, *reh. denied*, 376 U.S. 973 (1964); Compco Corp. v. Day-Bright Lighting, Inc., 376 U.S. 234, *reh denied*, 377 U.S. 913 (1964). *See* notes 35-45 *supra* and accompanying text.

[71]*See, e.g.*, W. PROSSER, LAW OF TORTS, 956-57 (4th ed. 1971).

[72]The case of Lear, Inc. v. Adkins, 395 U.S. 653 (1969), merely put off the issue. *Lear* involved an engineer, Adkins, whose employment contract specified he was to have title and control over his invention, but that he would license Lear in return for a royalty. Adkins developed a gyroscope improvement and applied for a patent. Pending patent approval, Adkins entered a licensing arrangement with Lear. Adkins then left Lear, and Lear ceased paying royalties. The patent issued, and Adkins sued Lear on breach of the license. The Court analyzed the protection of the improvement before the patent issuance as one of trade secret, and Adkins' rights to recovery or royalties prior to the issuance turned on the validity of the state trade secret law. The Court posed the question of such validity, but then declined to answer it: "[W]e should not now attempt to define in even a limited way the extent, if any, to which the States may properly act to enforce the contractual rights of inventors of unpatented secret ideas. 395 U.S. at 675.

[73]416 U.S. 470 (1974).

the Sixth Circuit's denial of injunction.[74] The Sixth Circuit had found conflict between Ohio's trade secret law[75] and the federal patent laws. The Court examined first whether states were forbidden to protect intellectual property in the form of trade secrets. Using the *Goldstein*[76] rationale[77] the Court found no proscription of state protection of trade secrets[78] as long as "in regulating the area of patents and copyrights [the states] do not conflict with the operation of the laws in this area passed by Congress."[79] The Court articulated the policies behind both patent and trade secret law[80] determined that there was no conflict,[81] and concluded that "patent law does not preempt trade secret law."[82]

Even though it now appears that state trade secrecy laws are valid, it is questionable that they are of any value to IC manufacturers. First, there is no secret to be misappropriated. All ICs are sold either in the form of packaged devices or as dice (naked chips). A prospective mask pirate would find it relatively easy to free the chip from its package and photograph it as described above. Obviously, the IC package represents no problem if the circuit is sold in die form. Since it is not illegal to dissolve the epoxy package or break the hermetically sealed package lid, the mask patterns may be viewed and photographed freely. The secret is, or could be as safe as its vault, the package. Present

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[74] 478 F.2d 1074 (1973).

[75] Ohio had adopted the definition of trade secret in the RESTATEMENT OF TORTS § 757, Comment (b)(1939). 416 U.S. at 474 *See* note 60 *supra* and accompanying text.

[76] Goldstein v. California, 412 U.S. 546 (1973).

[77] *See* notes 46-52 *supra* and accompanying text.

[78] *See* Goldstein v. California, 412 U.S. 546, 556-58 (1973).

[79] 416 U.S. at 479.

[80] 416 U.S. at 480-82.

[81] "Trade secret law and patent law have co-existed in this country for over one hundred years. Each has its particular role to play, and the operation of one does not take away from the need for the other." 416 U.S. at 493.

[82] *Id. Kewanee* is still good law today, as the recent decision of Aronson v. Quick Point Pencil Co., 47 U.S.L.W. 4219 (February 28, 1979), makes clear. Petitioner in *Quick Point* had contracted with respondent company to receive royalties in return for the exclusive right to make and sell petitioner's original, but simple keyholder. They agreed that respondent would pay petitioner a royalty of 5% of sales if petitioner secured a patent on the keyholder within 5 years, but 2½% of sales if petitioner's patent was denied. The agreement was to last as long as respondent sold petitioner's keyholder. Petitioner's patent application was denied. Respondent had preempted the market initially, but other competitors soon appeared, and respondent attempted to have the agreement with petitioner declared unenforceable under the rationale of Lear, Inc. v. Adkins, 395 U.S. 653 (1969), Sears, Roebuck & Co. v. Stiffel Co., 376 U.S. 225 (1964), and Compco Corp. v. Day-Bright Lighting, Inc., 376 U.S. 234 (1964). The Court, however, used *Kewanee* to find the agreement to pay 2½% royalty indefinitely even less offensive to federal patent law than the state trade secret law: "our holding in *Kewanee Oil Co.,* . . . puts to rest the contention that federal law pre-empts and renders unenforceable the contract made by these parties." 47 U.S.L.W. at 4221.

technology simply does not afford the needed impregnability at a marketable price.[83] It should be noted that since ICs are basically not repairable if defective, there is no reason not to package them as securely as possible. Second, as the Supreme Court made clear in *Kewanee*, "reverse engineering"[84] is a perfectly legal method of discovering a trade secret.[85] Reproducing the mask sets of another IC manufacturer by photographing is just such reverse engineering and is not proscribed.

The nonstatutory modes of protection of unfair competition and trade secret are totally inadequate as applied to ICs. Statutory modes of protection of patent and copyright offer more hope and are examined next.

B. Statutory Protection

The constitutional basis upon which the law of patents and copyright rests is in Article I, section 8: "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."

The scope of "writings" and "discoveries" as a constitutional limit has generally been held broad,[86] and so it is reasonable to assume that no constitutional objection exists to statutory protection of IC masks or reticles.

1. *Patent Protection*

Patents[87] are a statutory means of protection which might be applied to ICs.[88] Patents afford the greatest degree of protection but are relatively harder to procure than other kinds of protection.

The statutory hurdles which an IC mask or reticle would have to

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[83]CONTU Meeting 19, *supra* note 27, at 48.

[84]*See* note 25 *supra*.

[85]*See* note 67 *supra*.

[86]*See, e.g.*, Kalem Co. v. Harper Bros., 222 U.S. 55 (1911); White-Smith Music Co. v. Apollo Co., 209 U.S. 1 (1908); Bleistein v. Donaldson Lithographing Co., 188 U.S. 239 (1902); United States v. Duell, 172 U.S. 576 (1899); Burrow-Giles Lithographic Co. v. Sarony, 111 U.S. 53 (1884); Trade-Mark Cases, 100 U.S. 82 (1879); McClurg v. Kingsland, 42 U.S. (1 How.) 202 (1843); Wheaton v. Peters, 33 U.S. (8 Pet.) 590 (1834); Grant v. Raymond, 31 U.S. (6 Pet.) 218 (1832). *See generally* 1 WALKER ON PATENTS §§ 10-11 (A. Deller 2d ed. 1972).

[87]35 U.S.C. §§ 1-293 (1976).

[88]It should be noted at the outset that circuit designs and the IC planar process are each separately patentable. Here only the patentability of a mask or set of masks is at issue.

surmount are fourfold.[89] The mask must be statutory subject matter,[90] it must be novel,[91] it must be nonobvious to one skilled in the art,[92] and it must be sufficiently disclosed to permit one skilled in the art to make use of the invention.[93] Patent protection lasts seventeen years[94] and provides its owner a monopoly on the "use, manufacturer, or sale"[95] of the invention durnig that period.[96]

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[89]There is a fifth judicially created requirement, first stated in Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Co., 340 U.S. 147 (1950). In that case all the elements of the putative invention were known in the prior art, as was the particular combination of such elements. The Court announced that "only when the whole in some way exceeds the sum of its parts is the accumulation of old devices patentable. . . . This case is wanting in any unusual or surprising consequences from the unification of the elements here concerned." *Id.* at 1527. In 1952, the patent law was revised, but the synergy requirement has apparently survived. In Anderson's-Black Rock, Inc. v. Pavement Salvage Co., 396 U.S. 57 (1969) the Court again applied the *A&P* synergy doctrine to a combination of previously known elements and rejected the patent. "A combination of elements may result in an effect greater than the sum of the several effects taken separately. No such synergistic result is argued here." *Id.* at 61. Note that this weak, subjective requirement only applies if the patent is for a rearrangement or new combination of old elements. This would undoubtedly be applied in any action to patent an IC mask.

There are signs that the synergy requirement may die a deserved death. In Republic Indus., Inc. v. Schlage Lock Co., [1978] 417 P.T.C.J. (BNA) D1 (7th Cir. February 1, 1979), the court rejected the synergy requirements and instead used the basic requirements set out in Graham v. John Deere, 383 U.S. 1 (1966). *See* notes 126-33 *infra* and accompanying text.

Some writers view the post-*Graham* resurrection of the *A&P* synergy doctrine in *Anderson's-Black Rock* as no more stringent than the § 103 nonobviousness test and completely consistent with it. *See, e.g.*, Rich, *Laying the Ghost of the "Invention" Requirement*, 1 AM. PAT. L. ASS'N Q.J. 26, at 42-45 (1972). Yet the standards of "nonobviousness to one skilled in the art" and of "more than the sum of its parts" are obviously different and independent.

[90]35 U.S.C. § 101 (1976).

[91]35 U.S.C. § 102 (1976).

[92]35 U.S.C. § 103 (1976).

[93]35 U.S.C. § 112 (1976).

[94]35 U.S.C. § 154 (1976).

[95]*See* Zenith Radio Corp. v. Hazeltine Research, Inc., 395 U.S. 100 (1969).

[96]Design patents are another form of protection authorized in 35 U.S.C. § 171 as follows:

> Whoever invents any new, original and ornamental design for an article of manufacture may obtain a patent therefor, subject to the conditions and requirements of this title.
>
> The provisions of this title relating to patents for invention shall apply to patents for design, except as otherwise provided.

IC masks are not eligible because they are not ornamental as required. *See* Franklin Knitting Mills v. Gropper Knitting Mills, 15 F.2d 375 (2d Cir. 1926). As Justice Strong said in Gorham Mfg. Co. v. White, 81 U.S. 511 (1872), design patents "contemplate not so much utility as appearance, and that, not an abstract impression or picture, but an aspect given to those objects mentioned in the Acts. . . . It is the appearance itself . . . that constitutes mainly . . . the contribution to the public which the law deems worthy of recompense". *Id.* at 254.

STATUTORY CATEGORIES

The first hurdle is that of falling within the statutory classes. These include "any new or useful[97] process, machine, manufacture, or composition of matter, or any new and useful improvement thereof."[98] Of these categories, it is clear that IC masks do not qualify as a new composition of matter,[99] as would say, a new aluminum alloy.

Is an IC mask a new process? In section 100(b) a statutory process is defined as a "process, art or method, and includes a new use of a

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Of course, there may be mask aficionados to whom IC masks are ornaments, but this would not give rise to their classification as ornaments. Design patents really are a hybrid category between copyright and patents described in 35 U.S.C. § 10, and in some cases one can choose between a design patent and a copyright.

> It is apparent that ... a certain object may be an article of manufacture as well as a work of art and the design therefore might well come under the Design Patent Law as a design for an article of manufacture or under the Copyright Act as a design for a work of art. ... The Design Patent Law and the Copyright Law afford different types of protection. ... In a case which comes under either statute, it becomes a matter of choice by the author or owner whether he will seek protection under the patent or copyright law.

Jones Bros. Co. v. Underkoffler, 16 F. Supp. 729, 730-31 (M.D. Pa. 1936). Most courts hold that the choice of one form of protection excludes the other:

> Nevertheless, when the painting left the artist's hand, it was of such a character as made it eligible either for copyright or for patenting, at the option of the author or owner. ... Since it was qualified for admission into the two statutory classes, I see no reason why it might not be placed in either. But it could not enter both.

Louis DeJonge & Co. v. Breuker & Kessler Co., 182 F.150, 151 (E. D. Pa. 1910), *aff'd on other grounds*, 191 F. 35 (3d Cir. 1911), *and* 235 U.S. 33 (1914). The Second Circuit, however, has held that copyrights and design patents are not mutually exclusive. *See* Vacheron & Constantin-Le Coultre Watches. Inc. v. Benrus Watch Co., 260 F.2d 637 (2d Cir. 1958) (unenforceable copyright no bar to securing a design patent), *and* Korzybski v. Underwood & Underwood, Inc., 36 F.2d 727 (2d Cir. 1929) (concurrent patent and copyright permissible, but copyright invalid when it discloses no more than already contained in patent). The Supreme Court has expressly declined to pass on the issue. Mazer v. Stein, 347 U.S. 201, 217 (1954). It is generally held, however, that mechanical patent and copyright are mutually exclusive. Brown Instrument Co. v. Warner, 161 F.2d 910 (D.C. Cir. 1947); Taylor Instrument Co. v. Fawley-Brost Co., 139 F.2d 98 (7th Cir. 1943).

[97]"New" and "useful" are terms of art, but mean basically what they say. A book is not "useful" and cannot be patented (though *because* it is not useful, it will fit into copyright). *See* notes 114-33 *infra* and accompanying text. "New" is also governed by section 102, and the section 101 use of "new" does not enlarge on this.

[98]35 U.S.C. § 101 (1976).

[99]"Composition of matter" embraces chemical compounds, mechanical or physical mixtures, alloys ... [and] ... covers all compositions of two or more substances. It covers all composite products whether they are the result of chemical union, or of mechanical mixture, or whether they be gases, fluids, powders or solids. ... Every patent for a composition of matter or product must identify it so that it can be recognized independently of the description of the process for

known process, machine, manufacture, composition of matter, or material."[100] This circular definition is somewhat clarified by the classic explanation[101] in *Cochrane v. Deener*[102] that a process is a

> mode of treatment of certain materials to produce a given result. It is an act, or a series of acts, performed upon the subject matter to be transformed and reduced to a different state or thing. If new and useful, it is just as patentable as is a piece of machinery. In the language of patent law, it is an art. The machinery pointed out as suitable to perform the process may or may not be new or patentable; whilst the process itself may be altogether new, and produce an entirely new result. The [Cochrane] process requires that certain things should be done with certain substances and in a certain order; but the tools to be used in doing this may be of secondary importance.[103]

Neither the optical reticle nor the IC mask are "modes of treatment . . .

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making it. . . . [A] composition of matter cannot be patented . . . if the product was a well-known substance. 1 WALKER ON PATENTS § 18 (A. Deller 2d ed. 1972).

IC masks and reticles obviously do not fit this description, moreover, the "substance" of IC masks is already well-known.

[100] 35 U.S.C. § 100(b)(1976).

[101] One treatise writer gives the following definition of a process:

> The generic definition of a process is an operation performed by rule to produce a result. Processes may be grouped in the following classifications:
> (1) operations which consist partly or wholly in the employment of heat, light, electricity, magnetism, chemical or metallurgical action, pneumatics, hydraulics, or a force of nature or some other force producing physical, chemical or metallurgical change;
> (2) operations which consist entirely of mechanical transactions and which are only the peculiar functions of the respective machines which are constructed to perform them; and
> (3) operation which consist entirely of mechanical transaction, but which may be performed by hand or by any of several different mechanisms or machines.

1 WALKER ON PATENTS § 15 (A. Deller 2d ed. 1972).

Processes of the first category are patentable. *See* Cochrane v. Deener, 94 U.S. 780 (1877). Processes of the third category are also patentable. *See* Expanded Metal Co. v. Bradford, 214 U.S. 366 (1909). Processes of the second category are not patentable. Carnegie Steel Co. v. Cambia Iron Works, 185 U.S. 403 (1902). Another treatise writer states:

> An art or operation or process is an act or series of acts performed by some physical agent upon some physical object, and producing on such object some change either of character or of condition. It is also called a "process," or a "mode of treatment," and is said to require that "certain things should be done with certain substances in a certain order." 1 ROBINSON ON PATENTS § 159 (1890).

It appears that the IC masks and reticles are the result of a process, and not the process itself. *See also* New Porcess Fermentation Co. v. Maus, 122 U.S. 413 (1887)(beer process); Tilghman v. Proctor, 102 U.S. 707 (1881)(glycerine process); Corning v. Burden, 56 U.S. (15 How.) 252 (1853)(iron pressing machine).

[102] 94 U.S. 780 (1876).

[103] *Id.* at 787-88.

to produce a given result" such as contemplated in *Cochrane;* they are merely objects to be used in a process to produce the end manufacture, chips.[104]

It also is unlikely that the entire set of reticles or masks could be a process comprised of a series of acts or steps. As one treatise writer has stated:

> The patentability of a process comprising such a series of acts or steps depends upon the novelty of one or more of the acts or steps or the order of the acts or steps and the inventiveness of such novelty. . . . In short, in order to have a patentable process, it must be a novel process. . . .[105]

If an individual mask is not patentable, the entire set will also not be patentable since no mask is (by hypothesis) novel enough to be separately patented, and since the order is fixed by the manufacturing process and is not novel.

Are IC masks a machine? "A machine is a concrete or tangible thing consisting of parts or of certain devices and combinations of devices. A machine is not a principle or idea."[106] "Apparatus" is actually a more accurate description of what is encompassed by "machine."[107] Here there is little doubt that the projection system for the masks, the diffusion ovens for the wafers, and the finished parts themselves[108] may be patentable machines, but the masks and reticles are almost certainly not machines. Masks and reticles do not fit the common notion of what constitutes a machine. They do not exhibit motion, transform or transmit motive power, or have predetermined patterns of action resulting from their own operation. They do not "operate." They are more of

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[104]It is obvious, however, that the IC planar process is such a statutory process. Two categories of processes have been excluded judicially. One is a process which could be performed by the human mind alone. *See In re* Abrams, 188 F.2d 165 (C.C.P.A. 1951), *In re* Yuan, 188 F.2d 377 (C.C.P.A., 1951); *but see In re* Prater, 415 F.2d 1378 (C.A.P.A. 1968) where the *Abrams* "mental steps" doctrine was significantly limited to applications where the human mind is *necessarily* involved in the claimed process. *Abrams* was further eroded in *In re* Musgrave, 431 F.2d 882 (C.C.P.A. 1970). The other excluded category is mathematical problem solving algorithms. *See* Gottschalk v. Benson, 409 U.S. 63 (1972).

[105]1 WALKER ON PATENTS § 15 (A. Deller 2d ed. 1972) at 116.

[106]*Id.* at 120.

[107]*Id.* at 119. Robinson defines a machine as:

> an instrument composed of one or more mechanical powers, and capable, when set in motion, of producing, by its own operation, certain predetermined physical effects. It is an artificial organism, governed by a permanent artificial rule of action, receiving crude mechanical force from the motive power, and multiplying, or transforming, or transmitting it, according to the mode established by that rule. 1 ROBINSON ON PATENTS § 173 (1890).

[108]For example, in an IC using a new circuit design, the circuit design is patentable. In a microcomputer using a new computer architecture, that architecture is patentable and the microcomputer may be considered a new machine.

the nature of a "principle or idea" upon which the machine (circuit) functions; they might be construed as merely a manifestation of the principles, equations, and physical laws which govern the operation of the ultimate machine. If so construed, they are clearly nonstatutory. "[T]he principle of a machine is properly defined to be its peculiar or special mode of operation and is not to be confused with a machine per se. The latter may be the subject of a patent whereas the former may not be."[109]

Finally, are IC masks articles of manufacture? Of all the categories, IC masks seem to distort manufacture the least.[110] Generally, it must appear that the new article of manufacture involved the exercise of invention or discovery beyond what was necessary to create the apparatus which produces the article.[111] Patentability is not dependent on whether or not the article could be produced on previously existing machines,[112] but an article made from raw material must possess a new or distinctive form, quality, or property.[113] A gross generalization is that the "manufacture" is the output of the process of manufacturing; it is the "widget" itself, not the method by which it was produced, nor the machine which produced it, nor the composition of matter of the output. Certainly many IC masks possess distinctive forms as compared to other IC masks, and they require something beyond what was necessary to create the mask-making apparatus itself. Of all statutory categories, "manufacture" is the most likely to admit IC masks and reticles. However, IC masks and reticles must still pass muster under the novelty, nonobviousness and disclosure requirements. The requirements of novelty and nonobviousness are undoubtedly the most severe obstacles to patentability of IC masks and reticles. The fact that IC

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[109] I WALKER ON PATENTS § 16 (A. Deller 2d ed. 1972) at 122. This is a restatement of a long-standing tenet of patent law. "A principle, in the abstract, is a fundamental truth; an original cause; a motive; these cannot be patented, as one can claim in either of them an exclusive right." LeRoy v. Tatham, 55 U.S. (14 How.) 156, 175 (1852); "An idea of itself is not patentable." Rubber-Tip Pencil Co. v. Howard, 87 U.S. (20 Wall.) 498, 507 (1874); "It is conceded that one may not patent an idea." Gottschalk v. Benson, 409 U.S. 63, 71 (1972).

[110] "[T]he term 'manufacture' embraces whatever is made by the art of industry or man but excludes 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." I WALKER ON PATENTS § 17 (A. Deller 2d ed. 1972) at 123. It appears that the category of manufacture is a sort of catchall, sweeping in much of what process, machine, and composition of matter do not. This broad scope makes inclusion of IC masks and reticles relatively easy since masks, for example, are manufactured in the mask-making process.

[111] *Id.* at 124.

[112] *Id.*

[113] *Id.*

masks can be produced on previously existing machines only makes obvious and nonnovel improvements of these machines unpatentable, not the specific mask set itself.

NOVELTY AND NONOBVIOUSNESS

Even if IC masks are statutory subject matter, say a "manufacture," the requirements of novelty[114] and nonobviousness[115] are perhaps insurmountable hurdles. Section 102[116] requires[117] that the item be novel and not extant in the prior art. Section 103[118] requires[119] that the invention be nonobvious at the time the invention was made to a person having ordinary skill in the art. While in many cases the layout of an IC mask will be such that no identically similar mask exists, it is a

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[114] 35 U.S.C. § 102 (1976).
[115] 35 U.S.C. § 103 (1976).
[116] 35 U.S.C. § 102 (1976).
[117] Section 102 provides:

A person shall be entitled to a patent unless
a. the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent, or
b. the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of 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 application for patent in this country or an application filed more than twelve months before the filing of the application in the United States, or
e. the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or
f. he did not invent the subject matter sought to be patented, or
g. before the applicant's invention thereof the invention was made in this country by another who had not abandoned, suppressed, or concealed it. In determining priority of invention there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by the other.

[118] 35 U.S.C. § 103 (1976).
[119] Section 103 provides:

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

rare case that the layout is novel in view of prior art. It is almost inconceivable that the layout will be nonobvious to a person with skill in the art.[120] Since the inception of integrated circuits, so many chips have been developed that many mask layouts representing a given circuit or fragment exist.[121]

Layout designers are highly paid[122] and valued for their ability to juxtapose and reconfigure mask designs to obtain the desired result. Most layout designers attack a layout problem by first separating the circuit into logical "blocks."[123] Just as certain circuit configurations tend to be used over and over as building blocks in different applications once their efficacy is proven, so the accompanying layout will also be used over. Thus if the layout were compared to previously known layouts there would be a novelty and nonobviousness requirement[124] on the juxtaposition and reconfiguration of these "blocks."[125]

In *Graham v. John Deere Co.*,[126] the Supreme Court for the first time[127] interpreted the scope of Section 103. The Court outlined a

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[120]Computers are used nowadays to help in mask layout, especially for masks with repetitive designs. While present computer-aided layout is not as efficient or capable of minimizing the chip area as human layout, this could change in the next 10 to 20 years. Would the standard then be non-obviousness to a computer programmed in the art? What if the computer could self-program?

[121]This is not fatal, however. If a mask consisted of 90% old and obvious layout, and 10% new and nonobvious layout, then it would still meet the novelty and nonobviousness requirements since the article as a whole is new and nonobvious.

[122]Layout draftspersons are paid $20,000 to $30,000 on the average. CONTU Meeting 19, *supra* note 23, at 39.

[123]The author has personally performed such layout and has witnessed other layout designers.

[124]It is unlikely that given a finite number of fixed "blocks" an IC maker could arrange them in a manner which is both novel and nonobvious. It is much more akin to a child arranging building blocks and while the process used to arrive at the result requires ingenuity and skill, the results is nearly always "obvious" in patent law parlance.

[125]Even assuming the IC maker can arrange the "blocks" in a novel and nonobvious manner, the judicially created synergy doctrine raises its ugly head. *See* note 89 *supra*. It may be true that for some layouts, a reconfiguration of "blocks" would lead to unexpected results. But for many circuits, especially digital ones, this is not usually the case. In addition, many obvious and known circuits are not designed to be connected to other obvious and known circuits. For the interconnected layout of several obvious and known circuits to qualify for patent, the patentee must show new, unexpected characteristics or improvements in circuit performance. This implies a new circuit has been created which exploits previously nonexistent characteristics of the layout (e.g., thermal balancing). But the layout "blocks" are known, do not display any surprising characteristics, and are in fact chosen for that reason. The IC maker is the victim of his own competence and industry.

[126]383 U.S. 1 (1966).

[127]Section 103 (codified at 35 U.S.C. § 103 (1976)) was enacted for the first time in the Patent Act of 1952, Pub. L. No. 593, 66 Stat. 792, as an attempt

three-step procedure for assessing nonobviousness: "[T]he 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."[128] The first two steps are fairly objective and susceptible of proof.[129] The last step, however, is more problematic since it requires an assessment of the ordinary skill in the art.[130] It is almost impossible to objectively ascertain what is "ordinary skill" in, say, the IC industry which people are hired for their genius.

The *Graham* court also enumerated "[s]uch secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., [which] might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquiries may have

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to codify the preexisting case law doctrine of "invention." Beginning with the case of Hotchkiss v. Greenwood, 52 U.S. (11 How.) 248 (1850), the Supreme Court imposed an ever higher standard of "invention", which was akin to present-day "nonobviousness." In *Hotchkiss*, the Court held void a patent for a porcelain doorknob on a metal stem. Though there was no novelty in either the components, or the method of manufacture, the Court found the ensemble new and useful. The improvement was the use of a porcelain knob. Yet the Court voided the patent, saying:

> unless more ingenuity and skill in applying the old method . . . were required . . . than were possessed by an ordinary mechanic acquainted with the business, there was an absence of that degree of skill an ingenuity which constitute essential elements of every invention. In other words, the improvement is the work of the skilled mechanic, not that of the inventor. *Id.* at 266.

The "skilled mechanic" standard developed and remained over the next hundred years, though it was considerably refined. In Cuno Eng'r Corp. v. Automatic Devices Corp., 314 U.S. 84 (1941), for example, is the famous reformulation of the "skilled mechanic" standard: "the new device, however useful it may be, must reveal the flash of creative genius, not merely the skill of the calling." *Id.* at 90-91. *Cuno* was variously interpreted by lower courts. The court in Bellovance v. Frank Moira Co., 140 F.2d 419 (7th Cir. 1944) read *Cuno* as a heightened standard while the court in Brown & Starpe Mfg. Co. v. Kar Eng'r Co., Inc., 154 F.2d 48 (1st Cir. 1948) found no departure from the *Hotchkiss* "skilled mechanic" test. Congress desired in the 1952 Patent Act to lower the standard and make it more uniform. *See* Harris, *Some Aspects of the Underlying Legislative Intent of the Patent Act of 1952*, 23 GEO. WASH. L. REV. 658 (1955). However, the Supreme Court decided in Graham v. John Deere Co., 383 U.S. 1 (1966) that section 103 merely codified the existing precedent of the *Hotchkiss* doctrine of invention. "We conclude that the section was intended merely as a codification of judicial precedents embracing the *Hotchkiss* condition, with the congressional direction that inquires into the obviousness of the subject matter sought to be patented are a prerequisite to patentability." *Id.* at 17.

[128] 383 U.S. at 17.

[129] Rich, *Laying the Ghost of the "Invention" Requirement*, 1 AM. PAT. LAW ASS'N Q.J. 26, 38 (1972).

[130] *Id.*

relevancy."[131] These secondary factors have been used by lower courts in close cases[132] as deciding factors, though there is no direction in *Graham* that they may only be used in such cases. It seems that in the case of IC makers these factors would generally weigh in favor of patentability.[133]

Overall, the novelty and nonobviousness requirements are probably impossible to fulfill. IC masks and reticles look to the layman like carefully drawn mazes, and it would be difficult to persuade a judge that given one maze, another similar maze is novel or nonobvious. When the argument is pressed that the mask is nonobvious because it allows the circuit which it will construct to take advantage of certain nonobvious physical phenomena or properties, the mask could be rejected as a mere objectification of "principles or ideas." Prior art claims in the IC area would also be enormous. The logistics and practical problems associated with a prospective patentee's search of prior art are mind-boggling. This is especially so since none of the prior art is presently recorded or organized in a manner which would make a prospective patentee aware of preemption.

DISCLOSURE AND CLAIMS

Section 112[134] requires[135] that the patent describe with particularity the patented item such that any person skilled in the art could make and use the invention. If further requires the patent to include claims which demarcate the unique subject matter of the patent. This, in theory, permits others to know whether or not they are infringing the patent and whether or not any item they may wish to patent has been pre-

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[131] 383 U.S. at 17-18.

[132] *See, e.g.*, Westwood Chem., Inc. v. Owens-Corning Fiberglass Corp., 445 F.2d 911 (6th Cir. 1971). "[S]econdary indicia of nonobviousness are relevant and become supplementally useful only where there is a close question of whether the subject matter of an invention was obvious." *Id.* at 918.

[133] This would be less true when, for example, an IC maker was merely a second-source for an originating IC maker since there is no "failure of others." Yet there may still be an advance in mask and reticle layout made by such a second-source manufacturer.

[134] 35 U.S.C. § 112 (1976).

[135] Section 112 provides:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most clearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.
>
> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention. A claim may be written in independent or dependent

empted. Section 112 poses serious difficulties for would-be IC mask patentees. First, section 112 requires that the invention be described in writing. What would constitute a "writing" of a mask? Could a replica of the mask constitute a "writing"? Or would it have to include specifications such as: "Pattern Number 347, 1.5 mil wide, begins at x = 133, y = 47 and ends at x= 200, y = 47"? Second, and more troublesome, how could a claim be drafted which would sufficiently stake-out the protected area and also put others on notice of the extent of the protection? Finally, what would be claimed? The claims certainly must go beyond a mere description of the geometry of the mask. They cannot merely claim the circuit type, e.g., "Read Only Memory," since *that* would be either subject of a patent already or in the public domain. The "subject matter" of the invention is impossible to state, since usually any of a myriad of other masks would perform the same function equally well. This seems an insolvable problem, or the solution may be so cumbersome as to make patentability totally undesirable.

ARE MASK SETS HARDWARE OR SOFTWARE? THE ROM EXAMPLE

A different perspective from which to approach the protection of IC mask sets is computer software. Up to the present, the U.S. Supreme Court has thrice[136] held computer software to be unpatentable. However, it has never held computer software to be per se unpatentable.[137] The Court of Customs and Patent Appeals (CCPA) has been more lenient and granted several patents on computer software.[138] Since the

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form, and if in dependent form, it shall be construed to include all the limitations of the claim incorporated by reference into the dependent claim.

An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

[136] Parker v. Flook, 46 U.S.L.W. 4791 (1978); Dann v. Johnston, 425 U.S. 219 (1976); Gottschalk v. Benson, 409 U.S. 63 (1972).

[137] *See* Gottschalk v. Benson, 409 U.S. 63 (1972): "We do not hold that no process patent could ever qualify if it did not meet the requirements of our prior precedents. It is said that the decision precludes a patent for any program servicing a computer. We do not so hold." *Id.* at 71.

[138] *See, e.g., In re* Deutsch, 553 F.2d 689 (C.C.P.A. 1977); *In re* Chatfield, 545 F.2d 152 (C.C.P.A. 1976), *cert. denied*, 46 U.S.L.W. 3181 (Oct. 4, 1977); *In re* Noll, 545 F.2d 141 (C.C.P.A. 1976), *cert. denied*, 46 U.S.L.W. 3181 (Oct. 4, 1977); *In re* Brandstadter, 484 F.2d 1395 (C.C.P.A. 1973); *In re* Comstock, 481 F.2d 905 (C.C.P.A. 1973); *In re* Doyle, 482 F.2d 1385 (C.C.P.A. 1973); *In re* Knowlton, 481 F.2d 1357 (C.C.P.A. 1973); *In re* Foster, 438 F.2d 1011 (C.C.P.A. 1971); *In re* Ghiron, 442 F.2d 985 (C.C.P.A. 1971); *In re* McIlroy, 442 F.2d 1397 (C.C.P.A. 1971); *In re* Musgrave, 431 F.2d 882 (C.C.P.A. 1970); *In re* Bernhart, 417 F.2d 1395 (C.C.P.A. 1969).

Supreme Court has never faced the question of software patentability directly, the validity of CCPA patent affirmations is questionable. Nevertheless, they do open up a legal theory which may be advantageous to IC makers.

The CCPA has accepted two basic arguments for the inclusion of software as patentable subject matter under section 101. One[139] is that the program is a process, on the theory that the operation of an "old" computer with a new program is a new use of a known machine,[140] hence is patentable. This is one of the rationales relied on in *In re Bernhart,*[141] one of the early computer program patent cases. The second,[142] which is of more interest here, is that the program when combined with a general-purpose computing machine becomes a new, statutory special-purpose computing machine. *Ex parte King and Barton*[143] was the first case to allude to this theory; the theory emerged

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[139]*See, e.g., In re* Deutsch, 553 F.2d 689 (C.C.P.A. 1977); *In re* Chatfield, 545 F.2d 152 (C.C.P.A. 1976); *In re* Waldbaum, 457 F.2d 997 (C.C.P.A. 1972); *In re* Mabury, 421 F.2d 742 (C.C.P.A. 1970); *In re* Bernhart, 417 F.2d 1395 (C.C.P.A. 1969).

[140]This is within 35 U.S.C. § 100(b)(1976).

[141]The court in *In re* Bernhart, 417 F.2d 1395 (C.C.P.A. 1969) considered a patent rejection by the Patent Office Board of Appeals of applicant's apparatus for automatically making a two-dimensional portrayal of a three-dimensional object from any angle or distance and upon any plane of projection. The application contained both process and machine claims, and included, but did not solely claim, a set of equations to implement the projection. In addition, the application stated that the equation could be solved by digital computer. In reversing the machine claim reection, the court stated:

> There is one further rationale used by both the board and the examiner, namely, that the provision of new signals to be stored by the computer does not make it a new machine, i.e. it is *structurally,* the same, no matter how new, useful and unobvious the result. . . . To this question we say that if 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" of the unprogrammed machine has been, and Congress has said in 35 U.S.C. § 101 that such improvements are statutory subject matter for a patent. *Id.* at 1400.

[142]*See, e.g., In re* Johnston, 502 F.2d 765 (C.C.P.A. 1974) (dissent of Judge Rich), *rev'd,* Dann v. Johnston, 425 U.S. 219 (1976); *In re* Noll, 545 F.2d 765 (C.C.P.A. 1976); *In re* Comstock, 481 F.2d 905 (C.C.P.A. 1973); *In re* Knowlton, 481 F.2d 1357 (C.C.P.A. 1973); *In re* Prater, 415 F.2d 1393 (C.C.P.A. 1969); *Ex parte* King and Barton, 146 U.S.P.Q. 590 (Pat. Off. Bd. App. 1964).

[143]146 U.S.P.Q. 590 (Pat. Off. Bd. App. 1964). The Board stated the examiner's view that the computer

> operating on particular stored data, though a particular stored program is . . . patentably no different than [sic] a computer, absent such data and program. In other words, if the difference between a general purpose computer and the claim to a special purpose computer can be supplied by merely

full-blown in *In re Prater.*[144] Nowadays, many IC makers make single-chip microcomputers which are essentially complete except for input/output (I/O) devices. [145] These microcomputers typically contain not only a CPU,[146] but RAM,[147] clock, I/O buffering,[148] and most importantly, ROM.[149] The ROM is what makes the computer in question unique. The ROM is factory-programmed in accordance with the user's wishes and amounts to a permanent on-board program which transforms a potentially general-purpose machine (the microcomputer with an unprogrammed ROM) into a special purpose machine. Note that the processes used in making the microcomputer, the architecture of the microcomputer, the materials used in the microcomputer and the packaging of it are all separately patentable. What about the masks? It could be argued that the masks *are* the program for the microcomputer and are patentable under that rationale that they, *as the program,* have made the microcomputer a special-purpose machine.[150] When a customer buys such a microcomputer, he communicates to the IC maker

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> placing a suitable program in a general purpose machine then the examiner would deny the patent. . . .
>
> We do not agree. . . . Since most general purpose computers have the recognified [sic] capability of simulating operations of many other computers or machines by suitable programming, this fact should afford no basis for a denial of a patent on all future novel computer configurations which the art does not make obvious. *Id.* at 591.

[144]415 F.2d 1393 (C.C.P.A. 1969), *modifying* 415 F.2d 1378 (C.C.P.A. 1968). The Court gave its well-known "storeroom of parts" analysis:

> 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 non-obviousness. *Id.* at 1403 n.29.

[145]I/O devices include keyboards, cathrode-ray tube displays, printers, paper punches, and card readers.

[146]A CPU (central processing unit) is the "brains" of a computer. It performs all logical functions, accesses memory, and keeps track of various counters in the system.

[147]RAM (Random Access Memory) is memory to which the computer can write and from which it can read (also called Read-Write memory). It is not permanent and is usually volatile (information disappears when power is removed).

[148]I/O (Input/Output). Buffering means circuits which will retain the transient information flowing between the microcomputer and the I/O device so that the processor can move on to the next task and not have to wait until the I/O device is ready to assimilate or cummunicate the information.

[149]ROM (Read-Only Memory) is permanent, unalterable, nonvolatile memory. Usually the basic program and data required by the microcomputer are stored here. On modern single-chip microcomputer, ROM is typically 1K or 2K (1024 or 2048 bits) stored.

[150]*In re* Prater, 415 F.2d 1393, 1403 n. 29 (C.C.P.A. 1969); *In re* Bernhart, 417 F.2d 1395, 1400 (C.C.P.A. 1969), *principle reaffirmed in In re* Noll, 545 F.2d 141, 148 (C.C.P.A. 1976).

his desired ROM characteristics. Typically, this is conveyed by a truth table, a punched paper tape, a magnetic tape, or an already programmed ROM. The IC maker then alters that part of the microcomputer reticle set which will create the ROM, produces new masks, and makes the programmed microcomputer. Although part of the reticle remains constant and part is changed to meet the customer's request, the two are unified at the mask stage. Since the general purpose microcomputer is unquestionably a statutory machine, the programmed ROM turns that general purpose machine into a nonobvious special purpose machine.[151] The form of the program whether written on tape, on punched cards, or in integrated circuit masks should be irrelevant. No case dealing with software patentability has held that one *form* of the program (e.g, punched cards) is more or less patentable than any other.[152]

If a microcomputer with on-board programmed ROM *is* patentable as hypothesized above, is a bare programmed ROM? Accepting for a moment the above rationale, then if the patent is drafted so that the ROM is to be used with a general purpose microcomputer, the ROM should be patentable. The problem is, as before, convincing the court that the masks (when processed) *are* the program.[153]

An interesting question arises if it is assumed that the micro-

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[151]A typical microcomputer has a 1 K of on-board ROM (1024 bits). This means that $2^{1024} \approx 1.08 \times 10^{308}$ different logical configurations (and hence, different machines) are available. Does this alone imply that any configuration would be nonobvious? What if the machine only had a 3-bit (8 possibilities) ROM? No ROM (bare microprocessor)?

[152]This is unilke copyright. On May 19, 1964, the Register of Copyrights issued Announcement SML-47, Copyright Registration for Computer Programs, *reprinted in* 11 BULL. COPYRIGHT SOC'Y 362 (1964); 7 COM. ACM 450 (1964).

This announcement stated for the first time that the Copyright Office would register programs even though the practice was of doubtful legality. The Copyright Office justified the practice on the grounds that doubtful cases should be resolved in favor of copyrightability where possible. One of the requirements for registration was that "copies deposited for registration [must] consist of or include reproductions in a language intelligible to human beings." *Id. A print-out* (dump) of the program suffices.

[153]It should be generally noted that for ordinary computer programs apparatus patents offer less protection than a corresponding process patent. An apparatus patent only protects against others using the program, or its substantial equivalent, in conjunction with a computer. The idea could be pirated and reformulated in a noninfringing way. A process patent, on the other hand, protects the patentee from others using substantially equivalent processes. The process itself is protected from use regardless of whether an apparatus is used in conjunction to practice the process.

Under a new manufacture rationale, the ROM mask would have to be shown a new and nonobvious reorganization of previously known material. The synergy requirement could pose severe problems here. *See* note 89 *supra*. However, since the ROM is basically useless unless used with a computer, an apparatus patent of fers substantial protection against copied ROMs. Infringement would partcically be assured.

computer and ROM masks are patentable. Are *other* IC masks patentable? Would complex analog[154] circuitry be eligible, or is protection to be afforded only to digital[155] circuitry which can claim some nexus to software? While the ROM example is advanced only to show that IC mask protection might be based on a tie to existing law, the larger issue encompasses all IC masks, both analog and digital. It is clear that smaller masks of both varieties would fail under the novelty and nonobvious requirements, but would this be true of large, complex analog IC masks? It is submitted that there is no good reason to deny protection to all masks, if any protection is to be given at all. In fact, more is invested in complex analog circuit mask development than in the digital counterpart since digital circuitry is by its nature modular, so that whole blocks of circuits, and hence masks, can often be lifted and combined directly.[156] Analog circuitry is, in contrast, much more sensitive to layout,[157] so in general each circuit must be laid-out anew. Since the manufacturing process for analog and digital circuits is quite similar, the masks are equally "pirateable."

Overall, patentability is probably the wrong kind of protection to be given IC masks. First, the statutory categories must either be enlarged or altered to fit gracefully. Second, the novelty and nonobviousness requirements will be extremely difficult for layout engineers to

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[154]Analog circuits are defined *supra* note 22.

[155]Digital circuits are defined *supra* note 23.

[156]The patent law "doctrine of equivalents" is set forth in § 112 as follows:

> An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

This passage says two things. First, if the patented item relies in part on a previously known item, the previously known item does not have to be set out in detail itself. Second, no substitution of an equivalent of a combination covered by any claim will shield against an action of infringement. *See* 7 WALKER ON PATENTS 333 (A. Deller, 2d ed. 1972). The show infringement by equivalence, one must show that the substituted item performs the same function in substantially the same way as the claimed item. Sanitary Refrigerator Co. v. Winters, 280 U.S. 30 (1929). The doctrine is designed to stop "the unscrupulous copyist from making unimportant and insubstantial charges and substitutions in the patent which, though adding nothing, would be enough to take the copied matter outside ... the claim." Grover Tank & Mfg. Co. v. Linde Air Prods. Co., 339 U.S. 605, 607 (1950). Obviously, application of the doctrine of equivalents is quite sensitive to the scope and content of the claims. As applied to IC masks, this would prevent insignificant changes such as reshaping the metal contact pads or rounding sharp corners of designs as a means of evading infringement.

[157]For example, analog layout must take account of such problems as thermal balancing, metallization resistance, symmetry, and possible misregistration of superimposed masks on the chip, to name a few. Digital circuits generally are unaffected by such problems.

meet and for patent examiners to police. Third, the disclosure requirement would require either a new mode of specification or prose the prolixity of which would set new limits even for patents. Fourth, it would be nearly impossible to draft claims indicating what is claimed and what would infringe the mask. Fifth, since it takes 2 to 5 years to procure the average patent,[158] and the generational time for ICs is on the order of 2 years,[159] the IC would receive protection as it moves into middle age. Finally, a protection period of 17 years seems overly generous—development costs are usually recouped many times by the developer in that period.

2. *Copyright*

The most suitable way to protect against piracy of IC masks is copyright.[160] It is often said that copyright protects the form of the expression but not the idea behind it.[161] To be eligible for copyright, a work must be original.[162] It need not be new in the patent sense.[163] A copyright gives its holder the exclusive right to reproduce copies of the work,[164] to prepare derivative works,[165] and to distribute copies[166] as well as rights to perform[167] and to display[168] the work. Copyright protects

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[158]175 U.S.P.S. VIII (1973).

[159]RAM capacity is a convenient benchmark of industry technical progress. 1K RAMs were available in 1974, 4K RAMs in 1975, 16K RAMs in mid-1977, and 64K RAMs are being shipped now. *See* STANDARD AND POOR'S INDUSTRY SURVEY, ELECTRONICS-ELECTRICAL BASIC ANALYSIS, Sept. 7, 1978. A factor of 4 increase in capacity usually implies an advance in process technology.

[160]Copyright law is codified at 17 U.S.C. §§ 101-810 (1976). It was last revised in 1976. General Revisions of Copyright Law, Pub. L. No. 94-553, 90 Stat. 2541 (1976) [hereinafter cited as 1976 Copyright Act].

[161]*See* Kalem Co. v. Harper Bros., 222 U.S. 55 (1911); Baker v. Selden, 101 U.S. 99 (1879).

[162]In Burrow-Giles Lithographic Co. v. Sarony, 111 U.S. 53 (1884), the Supreme Court endorsed the following definition of an "author" within the meaning of the Constitution: "An author . . . is 'he to whom anything owes its origin; originator; maker; one who completes a work of science or literature." *Id.* at 57-58.

[163]*See* Baker v. Selden, 101 U.S. 99 (1879): "The copyright of a book, if not pirated from other works would be valid without regard to the novelty, or want of novelty, of its subject matter. . . . That is the province of letters-patent, not of copyright." *Id.* at 102.

See also Wihtol v. Wells, 231 F.2d 550 (7th Cir. 1956); "A copyright protects an original work and is not dependent upon novelty. . . . [N]othing in the Constitution commands that copyrighted matter be strikingly unique or novel." *Id.* at 553.

[164]17 U.S.C. § 106 (1) (1976).

[165]17 U.S.C. § 106 (2) (1976).

[166]17 U.S.C. § 106 (3) (1976).

[167]17 U.S.C. § 106 (4) (1976).

[168]17 U.S.C. § 106 (5) (1976).

against the misappropriation of one's own expressions but does not proscribe the independent creation of an identical work.[169] On the basic principle that one cannot copyright an idea or principle,[170] one cannot copyright any expression which is the minimal expression of an idea.[171] or one of a very limited number of possible expressions of an idea.[172] Such a copyright would be tantamount to a monopoly on the idea itself.[173] However, "while copyright will not protect ideas or the right to use copyrighted material, it will protect against actual copying of material designed for use when the material inseparably includes the copyrighted expression."[174] The copyrighted work cannot be extremely

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> [169][I]t is plain beyond peradventure that anticipation as such cannot invalidate a copyright. 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 anew Keats'[s] Ode on a Grecian Urn, he would be an "author," and, if he copyrighted it others might not copy that poem, though they might of course copy Keats'[s]. Sheldon v. Metro-Goldwyn Picture Corp., 81 F.2d 49, 54 (2d Cir. 1936)(L. Hand. Judge).

[170]17 U.S.C. § 102(b)(1976) states: "In no case does copyright protection for an original work of authorship extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied in such work."
such work."

This is a codification of the existing Copyright Office regulation which disallows as unregistrable: "ideas, plans, methods, systems, or devices, as distinguished from the particular manner in which they are expressed or described in a writing." 37 C.F.R. § 202.1(b)(1978).

See also Whist Club v. Foster, 42 F.2d 782 (S.D.N.Y. 1929) (laws or rules governing game, as distinguished from their expression, not copyrightable).

[171]Crume v. Pac. Mut. Life Ins. Co., 140 F.2d 182 (7th Cir. 1944):

> plaintiff recognizes defendant's right to the use of the plan or method taught by plaintiff, but denies to the defendant the right to use the words necessary to effect such use.... [W]here the use can be effected only in such manner, there can be no infringement even though the plan or method be copied. *Id.* at 184.

See Sampson & Murdock Co. v. Seaver-Radford Co., 140 F.539 (1st Cir. 1905) (city directory) *See also* Annot., 26 A.L.R. 585 (1923).

[172]Morrissey v. Procter & Gamble Co., 379 F.2d 675 (1st Cir. 1967) (game rules):

> 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.... We cannot recognize copyright as a game of chess in which the public can be checkmated. *Id.* at 678-79.

See Continental Cas. Co. v. Beardsley, 253 F.2d 702 (2d Cir. 1958); Dorsey v. Old Surety Life Ins. Co., 98 F.2d 872 (10th Cir. 1938). *See also* Annot., 119 A.L.R. 1250 (1939).

[173]Herbert Rosenthal Jewelry Corp. v. Kalpakian, 446 F.2d 738 (9th Cir. 1971) (jewel encrusted pin in the shape of a bee).

[174]Note, *Copyright Protection for Computer Programs Under the 1976 Copyright Act*, 52 IND. L.J. 503, 513 (1977). *See* Continental Cas. Co. v. Beardsley, 253 F.2d 702 (2d Cir. 1958).

simple and obvious,[175] and must be "found in the creative power of the mind."[176] There is, however, no requirement that the material to be copyrighted have any widely known or uniform meaning.[177]

What are the possibilities of copyright of IC masks? Initially, it must be determined that the optical reticle or masks themselves are copyrightable subject matter. Section 102[178] of the 1976 Copyright Act lists the requirements and categories of copyrightable material. First, the material must be an "original work of authorship."[179] Second, it must be "fixed in any tangible medium of expression." "A work is 'fixed'

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[175]*See, e.g.*, Tate Co. v. Jiffy Enterprises, Inc., 16 F.R.D. 571 (E.D.Pa. 1954) (instructions "apply hook to wall" held uncopyrightable).

[176]Trade-Mark Cases, 100 U.S. 82, 94 (1879). "The writings which are to be protected are *the fruits of intellectual labor. . . .*" *Id.*

[177]In Reiss v. Nat'l Quotation Bureau, 276 F.717 (S.D.N.Y. 1921), Learned Hand upheld the copyright on the "Simplix Pocket Blank Code," a list of about 6,000 five-letter words each of which had no recognized meaning, but was capable of being pronounced. The code was to be used by those needing a private code; the users would assign their own meanings to each word. "I can see no reason why words should not be [constitutional "writings"] because they communicate nothing. They may have their uses for all that, aesthetic or practical, and they may be the production of high ingenuity, or even genius." *Id.* at 719. It is interesting to note the change in Judge Hand's conception of the scope of "writings" of section 4 of the 1909 Copyright Law. 17 U.S.C. § 4 (1970). *Compare Reiss* ("The [Copyright] act must therefore be understood as meaning to cover all those compositions which, under the Constitution, can be copyrighted at all." 216 F. at 718.) *with* Capitol Records, Inc. v. Mercury Recording Corp., 221 F.2d 657 (2d Cir. 1955). *See also* Hartfield v. Peterson, 91 F.2d 998 (2d Cir. 1937) (code book)("[T]he compilation is the sum total of the words and phrases as arranged by the author and . . . the copyright is valid because of the originality of the combination." *Id.* at 1000.); American Code Co., Inc. v. Bensinger, 282 F.829 (2d Cir. 1922). Courts have also upheld tables and indices of nonalphabetic symbols. *See, e.g.*, Guthrie v. Curlett, 36 F.2d 694 (2d Cir. 1929); Edwards & Deutsch Lithographing Co. v. Boorman, 15 F.2d 35 (7th Cir. 1926).

[178]17 U.S.C. § 102(a)(1976) states:

> Copyright protection subsists . . . in original works of authorship fixed in any tangible medium of expression, now known or later developed, from which they can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device. Works of authorship include the following categories:
>
> (1) literary works;
> (2) musical works, including any accompanying works;
> (3) dramatic works, including any accompanying music;
> (4) pantomines and choreographic works;
> (5) pictorial, graphic, and sculptural works;
> (6) motion pictures, and other audiovisual works; and
> (7) sound recordings

[179]" 'Original' in reference to a copyrighted work means that the particular work 'owes its origin' to the 'author'." Alfred Bell & Co. v. Catalda Fine Arts, Inc., 191 F.2d 99, 102 (2d Cir. 1951). *See also* Burrow-Giles Lithographic Co. v. Sarony, 111 U.S. 53 (1884); Wihtol v. Wells, 231 F.2d 550 (7th Cir. 1956). "Independent creation" is the key. 1 M. NIMMER, COPYRIGHT § 2.01[A] (rev. ed. 1978).

in a tangible medium of expression when its embodiment is a copy . . . is sufficiently permanent or stable to permit it to be perceived, reproduced or otherwise communicated for a period of more than transitory duration.[180] The "Works" so "fixed" must be able to be perceived, reproduced or otherwise communicated directly or with machine aid.[181] While nowhere in the act is a "work" defined, "works of authorship" "include" seven categories.[182] It appears IC reticles and masks would fit at first glance into the category of "pictorial, graphic, and sculptural work."[183] This category is defined to include "two-dimensional and three-dimensional works of fine, graphic, and applied art, photographs, prints and art reproduction, maps, globes, charts, technical drawings, diagrams, and models."[184] This language alone would seem to make ample room for IC reticles and works. It is not difficult for the lawyer to envision words such as "applied art," "photographs," "technical drawings, diagrams, and models," as sweeping in IC masks. However, the next sentence creates the difficulties:

> Such works shall include works of artistic craftmanship insofar as their form but not their mechanical or utilitarian aspects are concerned; the design of a useful article, as defined in this section, shall be considered a pictorial, graphic, or sculptural work *only if, and only to the extent that*, such design incorporates pictorial, graphic, or sculptural features that can be identified separately from, and are capable of existing independently of the utilitarian aspects of the article.[185]

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[180] 17 U.S.C. § 101 (1976).

[181] 17 U.S.C. § 102 (1976).

[182] The term "include" is "illustrative and not limitative." 17 U.S.C. § 101 (1976). The Senate report on the 1976 Copyright Act adds that:

> the seven categories do not necessarily exhaust the scope of "original works of authorship" that the bill is intended to protect. Rather, the list sets out the general area of copyrightable subject matter, but with sufficient flexibility to free the courts from rigid or outmoded concepts of the scope of particular categories. The items are also overlapping in the sense that a work falling within one class may encompass works coming within some or all of the other categories. S. Rep. No. 473, 94th Cong., 1st Sess. 52 (1975). [hereinafter cited as Senate Copyright Report].

[183] 17 U.S.C. § 102 (5) (1976).

[184] 17 U.S.C. § 101 (1976). The Senate Copyright Report states that:

> The term is intended to comprise [maps, works of art, models or designs for works of art, reproductions of a work of art, drawings or plastic works of a scientific or technical character, photographs, and prints and pictorial illustrations including prints or labels used for articles of merchandise] in the present statute including not only "works of art" in the traditional sense but also works of graphic art and illustrations art reproduction, plans and drawings, photographs and reproductions of them, maps, charts, globes, and other cartographic works, works of these kinds intended for use in advertising and commerce, and work of "applied art."*Id.* at 53.

[185] 17 U.S.C. § 101 (1976).

"Useful article" is further defined as "an article having intrinsic utilitarian function that is not merely to portray the appearance of the article or to convey information. An article that is normally a part of a useful article is considered a 'useful article'."[186] Thus, a useful article cannot be copyrighted, and the artistic aspects can only be copyrighted to the extent they can be separated from the utilitarian aspect.

The "useful article" doctrine contained in the 1976 Copyright Act is a codification[187] of the leading case *Mazer v. Stein.*[188] In *Mazer,* respondent had produced and sold[189] lamps the bases of which were statuettes in the form of a Balinese dancer. He then submitted the statuette without any lamp components to the Copyright Office and secured registration of them. Respondent sold the lamps widely. Petitioner then proceeded to copy the lamp in its entirety. The Supreme Court upheld the lower court[190] finding of infringement. The Court first examined the history of the Copyright Law[191] and Copyright Office practice,[192] and found the statuettes copyrightable[193] despite the fact that they were mass produced and marketed.[194] The Court held the statuettes protected by copyright even though it was incorporated into the (utilitarian) lamp.[195]

The "useful article" doctrine has evolved somewhat since *Mazer.* It is important to ascertain just how the law has evolved since section

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[186]*Id.*

[187] H. R. REP. No. 1476, 94th Cong., 2d Sess. 105 (1976) [hereinafter cited as House Copyright Report.] *See* Senate Copyright Report, *supra* note 182, at 53.

[188]347 U.S. 201 (1954).

[189]The act of sale amounted to a "publication" under the old Copyright Law 17 U.S.C. § 26 (1970).

[190]Stein v. Mazer, 204 F.2d 472 (4th Cir. 1953). The Fourth Circuit held: "A subsequent utilization of a work of art as an article of manufacture in no way affects the right of the copyright owner to be protected against infringement of the work of art itself." *Id.* at 477.

[191]In particular, the Court noted that under the Act of 1870, copyrightable subject matter was defined as "any book, map, chart, dramatic or musical composition, engraving, cut, print, or photograph or negative thereof, or of a painting, drawing, chromo, statue, statuary, and of models or designs intended to be perfected as works of the fine arts." Act of July 8, 1870, ch. 130, § 86, 16 Stat. 212. Under the 1909 Copyright Law, this was changed to provide "[t]hat the works for which copyright may be secured under this Act shall include all the writings of an author." Act of March 4, 1909, ch. 320 § 4, 35 State. 1076. Thus, "[v]erbal distinction between purely aesthetic articles and useful works ended insofar as the statutory copyright language is concerned." 347 U.S. at 211.

[192]The Copyright Office had registered statuary as "works of fine art" both before the 1909 Copyright Law and after. 347 U.S. at 211-12.

[193]*Id.* at 214.

[194]*Id.* at 218.

[195]*Id.*

113 of the 1976 Copyright Act.[196] which deals expressly with the "useful article" doctrine, affords rights no greater or lesser than those afforded by law in effect on December 31, 1977. The case of *Esquire, Inc. v.*

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[196]Section 113 of the 1976 Copyright Act, "Scope of exclusive rights in pictorial, graphic and sculptural works," states:

(a) Subject to the provisions of subsection (b) and (c) of this section, the exclusive right to reproduce a copyrighted pictorial, graphic, or sculptural work in copies under Section 106 includes the right to reproduce the work in or on any kind of article, whether useful or otherwise.

(b) This title does not afford, to the owner of copyright in a work that portrays a useful article as such, any greater or lesser rights with respect to the making, distribution or display of the useful article so portrayed than those afforded to such works under the law, whether title 17 or the common law or statutes of a State, in effect on December 31, 1977, as held applicable and construed by a court in an action brought under this title.

(c) In the case of a work lawfully reproduced in useful articles that have been offered for sale or other distribution to the public, copyright does not include any right to prevent the making, distribution, or display of picture or photographs of such articles in connection with advertisements or commentaries related to the distribution or display of such articles, or in connection with news reports. 17 U.S.C. § 113 (1976).

Subsection (a) recognizes that copyrightable designs may be reproduced on useful articles which otherwise might invalidate a copyright. An example might be the ornamental design on a ceiling tile. Subsection (b) preserves intact previously existing rights with respect to the making, distributing, or selling of a useful article described or portrayed in a copyrightable work. An example here would be the right to build a house (useful article) by one in lawful possession of a copy of the plans (copyrightable). *See* notes 221-23 *infra* and accompanying text. If IC masks and reticles were copyrightable, this section would apply to the right to make the chips given the lawful possession of a copy of the masks or reticles. Subsection (c) allows one to make, distribute, and display a photograph or picture of a useful article containing a copyrighted work in connection with advertisement, commentary, or news report.

The House Copyright Report states:

> Section 113 deals with the extent of copyright protection in "works of applied art." This section takes as its starting point the Supreme Court's decision in *Mazer v. Stein*, 347 U.S. 201 (1954), and the first sentence of subsection (a) restates the basic principle established by that decision. The rule of *Mazer*, as affirmed by the bill, is that copyright in a pictorial, graphic, or sculptural work will not be affected if the work is employed as the design of a useful article, and will afford protection to the copyright owner against the unauthorized reproduction of his work in useful as well as non-useful articles. . . .
>
> [S]ubsection (a) of Section 113 raises questions as to the extent of copyright protection for a pictorial, graphic, or sculptural work that portrays, depicts, or represents an image of a useful article in such a way that the utilitarian nature of the article can be seen. . . .
>
> Section 113(b) reflects the Register's conclusion that "the real need is to make clear that there is no intention to change the present law with respect to the scope of protection in a work portraying a useful article as such."

Ringer[197] shows the present state of the doctrine of useful articles to be not much different from that at the time of *Mazer.*

In *Esquire,* plaintiff brought an action of mandamus against the Register of Copyright to register its lighting fixture used in parking lots. It was not disputed that except for the solely utilitarian purpose of the light it would meet all the requirements for registration.[198] The Copyright Office position was that no features of the lighting fixture could be identified separately from the shape of the intrinsically useful object and the design could not be identified separately as artwork.[199] Under the regulation[200] copyright was denied. The court issued the writ of mandamus a motion for summary judgment. The court found that the lights had two purposes, to decorate and to illuminate, and noted that art often has a utilitarian purpose. It was not for the Register of Copyright to set "any national standard of what constitutes art and the

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. . .

Section 113(c) provides that it would not be an infringement of copyright, where a copyright work has been lawfully published as the design of useful articles, to make, distribute, or display pictures of the articles in advertising, in feature stories about the articles, or in the news reports. House Copyright Report, *supra* note 187, at 105.

The Senate originally adopted a definition of "pictorial, graphic and sculptural works" as including only "two-dimensional and three-dimensional works of fine, graphic, and applied art, photographs, prints, and art reproductions, maps, globes, charts, plans, diagrams, and models." Senate Copyright Report, *supra* note 182, at 3. The House changed the definition to its present form. House Copyright Report, *supra* note 187, at 54-55. The Report explained:

> In adopting this amendatory language, the Committee is seeking to draw as clear a line as possible between copyrightable works of applied art and uncopyrightable works of industrial design. . . . The test of separability and independence from "the utilitarian aspects of the article" does not depend upon the nature of the design—that is, even if the appearance of an article is determined by esthetic (as opposed to functional) considerations, only elements, if any, which can be identified separately from the useful article as such are copyrightable. *Id.* at 55.

[197] 414 F. Supp. 939 (D.D.C. 1976), *rev'd,* 591 F.2d 796 (D.C. Cir. 1978). *Esquire* arose under the old Copyright Law. 17 U.S.C. §§ 1-216 (1970).

[198] 414 F. Supp. at 940.

[199] *Id.*

[200] 37 C.F.R. § 202.10(c) (1978) states:

> If the sole intrinsic function of the article is utility, the fact that the article is unique and attractively shaped will not qualify it as a work of art. However, if the shape of a utilitarian article incorporates features, such as artistic sculpture, carving, or pictorial representation, which can be identified separately and are capable of existing independently as a work of art, such features will be eligible for registration.

The Register of Copyrights stressed that this was a long-standing practice, expressed since 1910: "Production of the industrial arts utilitarian in purpose and character are not subject to copyright regestration, even if artistically made or ornamented." Rule 12(g), Copyright Office Rules and Regulations, Bull. No. 15 (1910), at 8, *quoted from* Mazer v. Stein, 347 U.S. 201, 212 (1954).

pleasing forms of the Esquire fixtures are entitled to the same recognition afforded more tradiional sculpure."[201] The court acknowledged policy considerations of allowing copyright on theretofore uncopyrightable useful articles,[202] but found the lighting fixture within the *Mazer* holding.

The court of appeals reversed.[203] The court, per Judge Bazelon, rejected Esquire's argument that since the *sole* function of the lighting fixtures, "works of modernistic form sculpture,"[204] was not utility, the fixtures should be copyrightable. The court accorded Copyright Office regulations[205] great weight[206] and noted that evidence indicated a long standing practice of disallowing industrial designs.[207] After concluding that the Copyright Office interpretation of the utilitarian object regulation was correct,[208] the court proceeded to draw further support from repeated congressional rejection of copyright for utilitarian objects as later expressed in the 1976 Copyright Act. The court noted that Title II of the original Senate version of the 1976 Copyright Act,[209] which was to protect ornamental design of useful articles,[210] had been excised by

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[201]414 F. Supp. at 941.

[202]The true difficulty which the Register envisions is the prospect of registering myriads of industrial designs of everything from automobiles to bathtubs to dresses. The consequent possibility of up to 56 years of protection and resulting inhibition upon competitive activity . . . is highly undesireable." *Id.*

[203]Esquire, Inc. v. Ringer, 591 F.2d 796 (D.C. Cir. 1978).

[204]*Id.* at 800 (citing brief for appellee at 5).

[205]37 C.F.R. § 202.10(c) (1978). *See* note 200 *supra*. The language of the definition of "pictorial, graphic, and sculptural works" finally adopted in the 1976 Copyright Act was amended by the House to include the useful articles doctrine in substantially the same form as Section 202.10(c). The original Senate version had only included "two-dimensional and three-dimensional works of fine, graphic, and applied art, photographs, prints and art reproductions, maps, globes, charts, plans, diagrams, and models." *See* House Copyright Report, *supra* note 187, at 54, 191. *See also* 17 U.S.C. § 101 (1976).

[206]591 F.2d at 801.

[207]*Id.*

[208]*Id.* at 800-01.

[209]Senate Copyright Report, *supra* note 182, at 39.

[210]Section 201 of Title II provided:

(a) The author or other proprietor of an original ornamental design of a useful article may secure the protection provided by this title upon complying with the subject to the provision hereof.

(b) For the purpose of this title

  (1) A "useful article" is an article which in normal use has an intrinsic utilitarian function that is not merely to portray the appearance of the article or to convey information. An article which normally is a part of a useful article shall be deemed to be a useful article.

  (2) The "design of a useful article", hereinafter referred to as a "design", consists of those aspects or elements of the article including its two-dimensional or three-dimensional features of shape and surface, which make up the appearance of the article.

the House.[211] Referring to the definition of "pictorial graphic, or sculptural works" in the 1976 Copyright Act,[212] the court noted that useful articles were defined to have *an* intrinsic utilitarian function, not the *sole* utilitarian function stated in the regulation[213] from which the statute was adopted.[214] The court saw the issue as "whether the overall shape of

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(3) A design is "ornamental" if it is intended to make the article attractive or distinct in appearance.
(4) A design is "original" if it is the independent creation of an author who did not copy it from another source.

Section 202 of Title II provided:

Protection under this title shall not be available for a design that is—
(a) not original;
(b) staple or commonplace, such as a standard geometric figure, familiar symbol, emblem, or motif, or other shape, pattern, or configuration which has become common, prevalent, or ordinary;
(c) different from a design excluded by subparagraph (b) above only in insignificant details or in elements which are variants commonly used in the relevant trades; or
(d) dictated solely by a utilization function of the article that embodies it;
(e) composed of three-dimensional features of shape and surface with respect to men's, women's, and children's apparel, including undergarments and outerwear. *Id.* at 39.

Other sections of Title II dealt with revision, commencement and term of protection, notice, infringement, and registration. *Id.* at 40-41. The purpose of Title II was "to encourage the creation of original ornamental designs of useful articles by protecting the authors of such designs for a limited time against unauthorized copying." *Id.* at 161. The Senate perceived existing copyright and design patent law as inadequate to protect such useful design. *Id.*

[211]The House simply deleted Title II from the proposed bill. The House Copyright Report stated:

> S. 22 is a copyright revision bill. The Committee chose to delete Title II in part because the new form of design protection provided by Title II could not truly be considered copyright protection and therefore appropriately within the scope of copyright revision.
>
> In addition, Title II left unanswered at least two fundamental issues which will require further study by the Congress. These are: first, what agency should administer this new design protection system and, second, should type for design be given the protection of the title?
>
> Finally, the Committee will have to examine further the assertion of the Department of Justice ... that Title II would create a new monopoly....
> House Copyright Report, *supra* note 187, at 50.

However, a design protection bill very similar to Title II recently has been introduced in the House. *See* H.R. 2706, 96th Cong., 1st Sess. (1979).

[212]17 U.S.C. § 101 (1976).

[213]37 C.F.R. § 202.10(c)(1976).

[214]The court speculated on the change:

> 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-dimen-

a utilitarian object is an 'article eligible for copyright',"[215] and concluded that *Mazer v. Stein*[216] did not apply.[217] The fixtures in *Esquire* were not easily segregable as were the table lamps in *Mazer*.

The court also rejected Esquire's argument that to deny the lighting fixtures copyright was an impermissible discrimination against modern abstract sculpture.[218] The copyright regulation did not discriminate against sculpture per se, but only against useful sculpture. Finally, the court found that the Copyright Office had properly applied its regulation to Esquire's claim. While Esquire at argument sought only to have the *housing* of the lighting fixture copyrighted, the application for registration claimed an "artistic design for lighting fixtures"[219] and thus was properly found denied.

Applying the "useful article" doctrine to IC masks and reticles, one is met by serious, if not insurmountable, problems. There is no question that the ICs themselves are useful. Art masks or reticles such a part of the useful IC that they too are useful? Analogy profitably might be made to architectural blueprints and the useful structures they describe.

It has long been true that architectural blueprints can be copyrighted,[220] but as the cases[221] show, this does not mean that one may not reproduce the described structure. Blueprints are not "useful articles" because they portray the article's appearance and convey information. One could measure the structure with a micrometer, reproduce it from the measurements, and build an identical structure without infringing the blueprint.[222] All that is proscribed is the actual copying of the blue-

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sional objects whose design is absolutely dictated by utilitarian considerations (Citation omitted.). 591 F.2d at 804.

[215]*Id.* at 804.

[216]347 U.S. 201 (1954).

[217]The court phrased the issue in *Mazer* as "whether objects that are concededly 'works of art' can be copyrighted if incorporated into mass-produced utilitarian articles." 591 F.2d at 804.

[218]*Id.* at 805.

[219]*Id.* at 806.

[220]*See* 37 C.F.R. § 202.12(a)(1978).

[221]*See, e.g.*, Imperial Homes Corp. v. Lamont, 458 F.2d 895 (5th Cir. 1972); Scholz Homes v. Maddox, 379 F.2d 84 (6th Cir. 1967); Herman Frankel Org. v. Tegman, 367 F. Supp. 1051 (E.D. Mich. 1973); Ga-On Homes, Inc. v. Spitzer Homes, Inc., 178 U.S.P.Q. 183 (M.D. Fla. 1973); De Silva Constr. Corp. v. Herrald, 213 F. Supp. 184 (M.D. Fla. 1962); Muller v. Triborough Bridge Auth., 43 F. Supp. 298 (S.D.N.Y. 1942).

[222]This is essentially what occurred in Imperial Homes Corp. v. Lamont, 458 F.2d 895 (5th Cir. 1972). Speaking to the issue of copyright infringement through reproduction of a structure described by copyrighted blueprints, the court applied the rationale of Baker v. Selden, 101 U.S. 99 (1879), "as holding that a descriptive copyright may not extend an exclusive right to the use of the described art itself lest originality of description should pre-empt nonnovel invention." 458

print itself, not what the blueprint describes. The blueprint or similar technical drawing, is useful, but not an article of utility. It is the expression of the idea of the structure, but does not become part of it as the definition of section 101 requires.[223]

Are IC reticles and masks copyrightable technical drawings or copyrightable articles of utility?[224] Do they describe the IC, or do they become part of it? A blueprint is a set of specifications or instructions. An IC mask can be viewed as such instruction because it is merely one way of expressing the construction to be followed in fabricating the IC. Or it can be viewed as the equivalent of the IC described itself since the mask is copied exactly by photoprojection onto the sensitized wafer to create the circuit design. An IC mask is really a template—it is a form to be followed exactly in the manufacture of ICs. There is no question that the ICs are useful, and that the mask design is part of the IC. The mask design should therefore be useful. A mask has a utilitarian function beyond *merely* portraying its own appearance;[225] reticles and masks are designed to be used in conjunction with the IC process and appurtenant machine, and ultimately became part of the utilitarian chip. Can any pictorial graphic or sculptural feature be identified separately from the utilitarian aspects of the mask or reticle?[226]

PRACTICAL USE

If it is supposed that masks and reticles are not utilitarian, then

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F.2d at 899. On remanding to determine whether infringement had occurred through copying the plans themselves, the court added "we do not hold that the [infringers] were in anyway restricted by the existence of . . . copyright from reproducing a substantially identical residential dwelling. All we hold is that if copyrighted architectural drawings of the originator of such plans are imitated or transcribed . . . infringement occurs." *Id.*

An exception is when the structure described is completely nonutilitarian. According to the House Copyright Report:

> A special situation is presented by architectural works. An architect's plans and drawings would, of course, be protected by copyright, but the extent to which that protection would extend to the structure depicted would depend on the circumstances. Purely non-functional or monumental structures would be subject to full copyright protection under the bill, and the same would be true of artistic sculpture. On the other hand, where the only elements of shape in an architectural design are conceptually inseparable from the utilitarian aspects of the structure, copyright protection for the design would not be available. House Copyright Report, *supra* note 187, at 55.

Query: What protection is available for the modern school of functional design in architecture?

[223]*See* note 186 *supra* and accompanying text.

[224]The possibility of IC masks having aesthetic appeal is discounted here.

[225]*Id.*

[226]*See* notes 183-86 *supra* and accompanying text.

they may be copyrighted as "pictorial, graphic, and sculptural works."[227] However, the IC maker is confronted then by the "practical use" doctrine.[228] The basic idea of this doctrine is that the copyright holder can prohibit others from copying, but not from using, his creation.[229] Then, since the IC mask is by hypothesis a nonutilitarian object like the blueprint, and the mask itself may not be copied, no infringement is created by copying and constructing the utilitarian article the mask describes. As one can without liability create the house described by its blueprint, one can create the IC described by its mask.

The most famous case dealing with practical use is *Baker v. Selden*.[230] In *Baker*, Selden had copyrighted a book describing a peculiar business ledger system and which contained representative forms. Baker's account books used a similar plan and forms, though slightly differently arranged. The lower court found copyright infringement; the Supreme Court reversed. The Court stated the issue as "whether the exclusive property in a system of bookkeeping can be claimed, under the law of copyright, by means of a book in which that system is explained?"[231] This the Court answered in the negative[232] and held no infringement because Selden had no claim of copyright in the system or plan, but only in its expression.[233] Baker was free, as all the public, to use the underlying system.

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[227] 17 U.S.C. § 101 (1976).

[228] *See* notes 171-73 *supra* and accompanying text. The "practical use" doctrine is to be distinguished from the "fair use" doctrine which permits one to copy a copyrighted work under certain conditions without the copyright owner's permission. The "fair use" doctrine is now codified at 17 U.S.C. § 107 (1976). *See also* Baker v. Selden, 101 U.S. 99 (1879) and American Institution of Architects v. Fenichel, 41 F. Supp. 146 (S.D.N.Y. 1941).

[229] The use of an IC usually involves its circuit operation. But it could also be used as a shim under he leg of a wobbly table or as the subject of microphotography. *See* Baker v. Selden, 101 U.S. 99 (1879).

[230] 101 U.S. 99 (1879).

[231] *Id.* at 101.

[232] "To give 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." *Id.* at 102.

[233] Now, whilst no one has a right to print or publish [Selden's] book, or any material part thereof, as a book intended to convey information in the art, any person may practise and use the art itself which he has described and illustrated herein. The use of the art is a totally different thing from a publication of the book explaining it. The copyright of a book on bookkeeping cannot secure the exclusive right to make, sell, and use accountbooks prepared upon the plan set forth in such book. . . .

The description of art in a book, though entitled to the benefits of copyright, lays no foundation for an exclusive claim to the art itself. The object of the one is explanation; the object of the other is use. *Id.* at 104-05.

The case of *Drury v. Ewing*,[234] cited in *Baker*,[235] is instructive. There, a copyright was claimed in a clothing pattern chart. Commenting on *Drury*, the Court said:

It is obvious that such design could only be printed and published for information,[236] and not for use in themselves. Their practical use could only be exemplified in cloth on the tailor's board and under his shears; in other words, by the application of a mechanical operation to the cutting of cloth in certain patterns and forms. Surely, the exclusive right to this practical use was not reserved to the publisher by his copyright of the chart.[237]

Baker has been followed[238] and is still good law.[239] As applied to ICs, it would appear that if the masks and reticles are nonutilitarian, they are not protected from "practical use."

AUDIOVISUAL WORKS

"Pictorial, graphic, and sculptural works" is not the only category in which IC masks and reticles might fit. They might also be construed "audiovisual works." The definition of "audiovisual works" is

works that consist of a series of related images which are intrinsicially intended to be shown by the use of machines or devices such as projectors, viewers, or electronic equipment, together with accompanying sounds, if any, regardless of the nature of the material objects, such as films or tapes, in which the works are embodied.[240]

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[234]1 Bond, 540.

[235]101 U.S. at 107.

[236]This is true *ex hypothesis* in the case of the IC masks reticle here. Otherwise they would be utilitarian and not copyrightable.

[237]101 U.S. at 107.

[238]*See, e.g.*, Morrissey v. Procter & Gamble Co., 379 F.2d 675 (1st Cir. 1967); Continental Cas. Co. v. Beardsley, 253 F.2d 702 (2d Cir. 1958); Alfred Bell & Co. v. Catalda Fine Arts, 191 F.2d 99 (2d Cir. 1951); Brown Instrument Co. v. Warner, 161 F.2d 910 (D.C. Cir. 1947); Taylor Instrument Co. v. Fawley-Brost Co., 139 F.2d 98 (7th Cir. 1943); Crume v. Pac. Mut. Life Ins. Co., 140 F.2d 182 (7th Cir. 1942); Guthrie v. Curlett, 36 F.2d 694 (2d Cir. 1929; Esquire, Inc. v. Ringer, 414 F. Supp. 939 (D.D.C. 1976), *rev'd*, 591 F.2d 796 (D.C. Cir. 1978); Muller v. Triborough Bridge Auth., 43 F. Supp. 298 (S.D.N.Y. 1942).

[239]Though in Mazer v. Stein, 347 U.S. 201 (1954), the Supreme Court seemed to limit somewhat the holding of *Baker*:

Thus in Baker v. Selden, 101 U.S. 99, the Court held that a copyrighted book on a peculiar system of bookkeeping was not infringed by a similar book using a similar plan which achieved similar results *where the alleged infringer made a different arrangement of the columns and used different headings*. 347 U.S. at 217 [emphasis supplied].

See also Scholz Homes, Inc. v. Maddox, 379 F.2d 84 (6th Cir. 1967).

[240]17 U.S.C. § 101 (1976).

Audiovisual works, along with motion pictures,[241] form one of the categories enumerated[242] under section 102[243]

The 1976 Copyright Act affords different protection to audiovisual works from pictorial, graphic and sculptural works. Under section 106[244] the copyright owner of an audiovisual work has the exclusive right to both "performance"[245] and "display"[246] while in the case of pictorial, graphic or sculptural works, only "display" rights are secured.[247] How-

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[241]"Motion pictures" are defined in section 101 as "audiovisual works consisting of a series of related images which, when shown in succession, impart an impression of motion, together with accompanying sounds, if any." 17 U.S.C. § 101 (1976). IC reticles and masks would not qualify as motion pictures because they do not impart an impression of motion. The House Copyright Report makes this clear. "[Motion pictures] would not include: . . . (3) filmstrips and slide sets which, although consisting of a series of images intended to be shown in succession, are not capable of conveying an impression of motion." House Copyright Report, *supra* note 187, at 56.

[242]*See* note 178 *supra*.

[243]17 U.S.C. § 102(a)(6)(1976).

[244]Section 106 states:

> Subject to sections 107 through 118, the owner of copyright under this title has the exclusive rights to do and to authorize any of the following:
> (1) to reproduce the copyrighted work in copies or phonorecords;
> (2) to prepare derivative works based on the copyrighted work;
> (3) to distribute copies or phonorecords of the copyrighted work to the public by sale or other transfer of ownership, or by rental, lease, or lending;
> (4) in the case of literary, musical, dramatic, and choreographic works, pantomimes, and motion pictures and other audiovisual works to perform the copyrighted work publicly, and
> (5) in the case of literary, musical, dramatic, and choreographic works, pantomines, and pictorial, graphic or sculptural works, including the individual images of a motion picture or other audiovisual work, to display the copyrighted work publicly. 17 U.S.C. § 106 (1976).

[245]Under Section 101, to "perform" a work "means to recite, render, play, dance, or act it, either directly or by means of any device or process or, in the case of a motion picture or other audiovisual work, to show its images in any sequence or to make the sounds accompanying it audible." 17U.S.C. § 101 (1976).

[246]Under Section 101, to "display" a work "means to show a copy of it, either directly or by means of a film, slide, television image, or any other device or process or, in the case of a motion picture or other audiovisual work, to show individual images nonsequentially." 17 U.S.C. § 101 (1976).

[247]Notice here the poor draftsmanship of sections 106 and 110 in the present context. In Section 106 (5) it seems as though individual images of a motion picture or other audiovisual work are classed as pictorial, graphic, or sculptural works, yet the House Copyright Report makes plain that this is not the case:

> [T]he bill equates audiovisual materials such as filmstrips, slide sets, and sets of transparencies with "motion pictures" rather than with "pictorial, graphic, and sculptural works." Their sequential showing is closer to a "performance" than to a "display", and the definition of "audiovisual works," which applies also to "motion pictures," embraces works consisting of a series of related images that are by their nature, intended for showing by means of projectors or other devices.

ever, only "public" displays and performances are proscribed. "Public" as defined in the 1976 Copyright Act would probably encompass the projection of IC masks and reticles at an IC manufacturing facility since there is no requirement that the showing be perceived by anyone.[248] Thus, if construed as a "pictorial, graphic or sculptural work" an IC mask or reticle would be protected only from public display while if construed as "audiovisual work" it would be protected from display and from performance.[249] This construction would not give the IC maker any more protection from reproduction,[250] preparation of derivative works,[251] or distribution or sale,[252] but would for example, prevent a would-be IC mask pirate from even projecting the images of the various masks within his plant. It is debatable whether this much protection is

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House Copyright Report, *supra* note 187, at 56.

Similarly, one can "perform" an audiovisual work by showing its images "in any sequence", but "displays" the work by showing "individual images non-sequentially." It is easy to imagine a case where these two are the same, yet different rights depend on the label. In the case of a two-slide show showing slide A only would be a "display" but not a "performance" while showing any two slides in either order would always be sequential (e.g., slide B, then slide A) and thus always a performance. The problem arises from a lack of definition of "sequential." If one reads between the lines of the House Copyright Report, *supra* note 187, one has the impression that the Committee intended "nonsequential" to encompass showings which were not an ensemble of related images (*e.g.*, a picture from slide set A, then one from slide set B, etc.) but nowhere is this made clear. The difference which the House should have made clear but did not between "in any sequence" and "non-sequential" is that "in any sequence" really means "out of sequence but that all images are still part of the same related set of images" while "non-sequential" implies that each individual image can be drawn from any source.

[248]Under Section 101, to perform or to display work "publicly" means

(1) to perform or display it at a place open to the public or at any place where a substantial number of persons outside of a normal circle of a family and its social acquaintances is gathered; or

(2) to transmit or otherwise communicate a performance or display of the work to a place specified by clause (1) or to the public, by means of any device or process, whether the member of the public capable of receiving the performance or display receives it in the same place or in separate places and at the same time or at different times.

That the definition of "public" would include any showing of an IC mask or reticle at, say, an IC factory is apparent from the Senate Copyright Report, *supra* note 182. "One of the principal purposes of the definition [of "public"] was to make clear that . . . performances in semipublic places such as clubs, lodges, factories, summer camps, and schools are public performances subject to copyright control." *Id.* at 60. *See also* House Copyright Report, *supra* note 187, at 64.

[249]When fabricating an IC the masks must be shown in a set sequence and they must all be from the same related set of images (for the particular IC being constructed). This would be a performance undoubtedly but probably not a display since the images are sequential.

[250]17 U.S.C. § 106(1)(1976).

[251]17 U.S.C. § 106(2)(1976).

[252]17 U.S.C. § 106(3)(1976).

needed in view of the policy of fostering competition.[253] One can easily conceive that a mask pirate would optically "disassemble" a competitor's IC, make cosmetic and other changes to accommodate the product to his process, and perhaps escape a charge of infringement. Proscribing the mere showing of the masks would confer protection one stage earlier in the process.

The chief advantage of construing masks and reticles as audiovisual works is that one may be able to get around the useful articles doctrine.[254] Because Congress explicitly separated out useful articles only in the category of pictorial, graphic, and sculptural works, one could argue that no such separation was intended for any other category.[255] However, one is still left with the practical use doctrine.[256]

"COPIES"

In addition to problems described above concerning the copyrightability of IC masks and reticles, there is also the question of what constitutes a "copy" of a mask. Section 101 of the 1976 Copyright Act[257] defines copies to be "material objects in which a work is fixed by any method now known or later developed, and from which the work can be perceived . . . either directly or with the aid of a machine or device. The term "copies" includes the material object . . . in which the work is first fixed."[258]

The 1976 Copyright Act tried to do away with the artificial construction placed on "copies"[259] in the case of *White-Smith Music Pub-*

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[253]"The copyright law, like the patent statutes, makes reward to the owner a secondary consideration." United States v. Paramount Pictures, Inc., 334 U.S. 131, 158 (1948).

[254]*See* notes 183-226 *supra* and accompanying text.

[255]Using the principle *expressio unius est exclusio alterius.*

[256]*See* notes 227-239 *supra* and accompanying text.

[257]17 U.S.C. § 101 (1976).

[258]*Id.*

[259]"Copies" are any material objects in which a work is "fixed." *See* note 180 *supra* and accompanying text. The issue really is one of the scope of "fixation." The Senate Copyright Report states that

> This broad language [of "fixation"] is intended to avoid the artificial and largely unjustifiable distinctions, derived from cases such as *White-Smith Publishing Co. v. Apollo Co.*, 209 U.S. 1 (1908), under which statutory copyrightability in certain cases has been made to depend upon the form or medium in which the work is fixed. Under the bill it makes no difference what the form, manner, or medium of fixation may be—whether it is in words, numbers, notes, sounds, pictures, or any other graphic or symbolic indicia, whether embodied in a physical object in written, printed, photographic, sculptural, punched, magnetic, or any other stable form, and whether it is capable of perception directly or by means of any machine or device "now known or later developed." Senate Copyright Report, *supra note* 182, at 51.

lishing Co. v. Apollo Co.[260] In *White-Smith* plaintiff brought suit to restrain the infringement of his two copyrighted musical compositions. Defendant sold player pianos and had manufactured perforated rolls which would reproduce plaintiff's songs on the piano. The Court affirmed the lower court's finding of no infringement. The Court observed that federal copyright protection is wholly statutory, and that Congress had not acted to place objects such as perforated music rolls specifically within the ambit of such protection. The Court approved the following rigid definition[261] of "copy": "A copy is that which comes so near to the original as to give to every person seeing it the idea created by the original."[262] Thus the Court required that a copy be visible and that it conjure up an image of the original when seen. The emphasis was on form of the copy,[263] not necessarily form of expression.[264]

Although Congress overruled the narrow holding of *White-Smith* the next year,[265] the basic principle of what constitutes a statutory copy remained until the 1976 Copyright Act. No case has emerged yet to explore the new limits of "copy," but given explicit congressional disapproval of narrow construction, it is unlikely the courts will again assume a rigid posture. The application of the 1976 Copyright Act results that if IC masks and reticles are statutory subject matter, then the chips themselves would be copies. If only the reticle is copyrightable, then the masks and chips would be copies.

See also House Copyright Report, *supra* note 187, at 52. "Fixation" is important because if IC reticles and masks are copyrightable subject matter under Sections 102 and 103, then fixation is the dividing line between common law copyright and statutory copyright. *See* Senate Copyright Report, *supra* note 182, at 51. If the work is statutory and fixed, then under Section 301(a) federal law preempts state common law copyright. 17 U.S.C. 301(a)(1976). But Section 301(b) leaves intact the power of the state to regulate when the subject matter is not covered by Sections 102 or 103. 17 U.S.C. § 301(b)(1)(1976).

[260] 209 U.S. 1 (1908).

[261] Definition from West v. Francis, 5 Barn. & Ald 743.

[262] 209 U.S. at 17.

[263] The *White-Smith* holding placed various forms of computer programs in considerable doubt as to copyrightability. *See* Iskrant, *The Impact of the Multiple Forms of Computer Programs on their Adequate Protection by Copyright*, 18 ASCAP COPYRIGHT L. SYMP. 92 (1970).

[264] It may be true that in a broad sense a mechanical instrument which reproduces a tune copies it; but this is a strained and artificial meaning. When the combination of musical sounds is reproduced to the ear it is the original tune as conceived by the author which is heard. These musical tones are not a copy which appeals to the eye. In no sense can musical sounds which reach us through the sense of hearing be said to be copies as that term is generally understood, and as we believe it was intended to be understood in the statutes under consideration.... It is not susceptible of being copied until it has been put in a form which others can see and read. 209 U.S. at 17.

[265] Act of March 4, 1909, ch. 320, 35 Stat. 1075.

COMMON LAW COPYRIGHT

If IC masks and reticles are not statutory subject matter, then although federal protection is foreclosed, state protection is not.[266] IC makers could avail themselves of the protection of state legislation, which in the case of the major IC producing states[267] would not be difficult. The 1976 Copyright Act appears to codify[268] the results of *Goldstein v. California*,[269] which affirmed the validity of state copyright laws in the absence of positive federal copyright law to preempt state law.[270] A discussion of common law copyright is outside the scope of this paper, but a major problem could arise from the interaction of a state copyright law protecting IC masks and reticles and that state's long-arm statute. A state conceivably could turn its copyright statute into the equivalent of nationwide protection. This would almost certainly be held unconstitutional.[271]

THE *INTEL* CASE

The problem of protection of IC reticles and masks is not a purely academic one. Some IC makers have already been victims or near-victims of piracy.[272] Attempting to thwart piracy of its model 8755 microcomputer, on November 3, 1976, the Intel Corporation registered nine mylar optical reticle sheets with the Register of Copyright under a Class I designation.[273] The registration form listed the copyrighted article as a

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[266]17 U.S.C. § 301(b) (1976) states:

(b) Nothing in this title annuls or limits any rights or remedies under the common law or statutes of any State with respect to—

(1) subject matter that does not come within the subject matter of copyright as specified by sections 102 and 103, including works of authorship not fixed in any tangible medium of expression.

[267]These are California, Texas, Florida, New York, and Massachusetts, ELECTRONIC INDUSTRIES ASSOCIATION, 1978 MARKET DATA BOOK 124.

[268]The House may have something else in mind. The purpose of Section 301(b), according to the House Copyright Report, "is to make clear, consistent with the 1964 Supreme Court decision in *Sears, Roebuck & Co. v. Stiffel*, 376 U.S. 225 and *Compco Corp. v. Day-Brite Lighting, Inc.*, 376 U.S. 234, that preemption does not extend to courses of action, or subject matter outside the scope of the revised Federal copyright statute." House Copyright Report, *supra* note 186, at 131. *Goldstein* cut back somewhat on the basic *Sears-Compco* holdings, *see* notes 47-53 and accompanying text. It is not clear why the House did not also include *Goldstein* in its discussion of Section 301.

[269]412 U.S. 546 (1973).

[270]*See* notes 47-53 *supra* and accompanying text.

[271]*See* Goldstein v. California, 412 U.S. 546 (1973).

[272]Telephone conversation with Roger S. Borovoy, Vice President and General Counsel, Intel Corporation. Mr. Borovoy indicated that since the settlement of this suit, the would-be mask pirates have been persuaded to procure a license on the masks from Intel.

[273]A Class I designation is given to "drawings or plastic work of a scientific or technical character." *See* 37 C.F.R. § 202.12 (1978).

"set of nine drawings on Mylar sheets." Intel released the 8755 for sale in March, 1977. On July 27, 1977, Intel sought to deposit with the Register of Copyright two finished 8755 chips as "copies of the published form" of the mylar reticles. The form accompanying the deposit clearly stated that no separate claim of copyright was being asserted in the chips themselves. The Copyright Office rejected the proferred chips on August 31, 1977, on the basis that the mylar drawings had been accepted originally only as technical drawings. The Copyright Office added that it was "the consistent policy of the Copyright Office to reject claims in the actual published chips."[274] Intel protested this action. The Register of Copyright responded on December 2, 1977, indicating that the Copyright Office considered the mylar reticle to be only an instructional material depicting the interrelationship of the layers of the chip. Articles of utility were not permissible as the subject of copyright. That which was reproduced in the chips was not copyrighted in the masks; that which was copyrighted in the masks was not protectable in the chips. On December 21, 1977, Intel filed an action[275] in the nature of mandamus to compel the Register of Copyrights to accept the deposit of two chips as published copies of the copyrighted mylar reticle. The case was settled after some interrogatories were filed and depositions taken.

The Copyright Office agreed to place two chips in the file containing the copyrighted reticle but did not accept them on the basis that the chips were the published form of the reticle.[276] This case arose under the copyright law in existence prior[277] to the 1976 Copyright Act. Because the new law went into effect on January 1, 1978,[278] and because Intel was the only company to attempt copyright registration of optical reticles before that date, both sides agreed to drop the case. Although the Copyright Office agreed to keep the chips, none of the real issues of the case was resolved.[279]

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[274]The letter of August 31, 1977, from the Copyright Office to Intel reflects the basic misunderstanding between the two. Intel did not claim any copyright in the chips *qua* chips, but only in the reticle. This chips were merely the first published form of the reticle.

[275]Intel Corp. v. Ringer, Register of Copyrights, No. C-77-2848-RHS (N.D. Cal., filed April 13, 1978).

[276]Conversation with Roger S. Borovoy, Vice President and General Counsel, Intel Corporation. Conversation with Richard Glasgow, Office of the General Counsel, Copyright Office, Washington, D.C.

[277]17 U.S.C. § 13 (1970).

[278]17 U.S.C. § 301(a) (1976).

[279]Conversation with Michael Cleary of Brylawski and Cleary, Washington, D.C. (Copyright counsel to Intel Corporation).

SUBSEQUENT DEVELOPMENTS

Following the *Intel* case, the Copyright Office planned to hold hearings in early 1979 to consider the copyrightability of IC reticles and masks.[280] However, these plans were abandoned following the introduction by Congressman Edwards of H.R. 1007,[281] which would amend the 1976 Copyright Act as follows:

> *Be it enacted* . . . That the paragraph beginning "Pictorial, graphic, and sculptural works" in Section 101 of title 17, United States Code, is amended by adding at the end thereof the following new sentence: "Such pictorial, graphic, and sculptural works shall also include the photographic masks used to imprint patterns on integrated circuit chips and include the imprinted patterns themselves even though they are used in connection with the manufacture of, or incorporated in a useful article.

This proposed legislation, a direct outgrowth of the *Intel* case,[282] faces the useful articles doctrine directly and in the limited case of IC masks, abrogates the doctrine. The bill covers only the photographic masks used and the resulting patterns on the IC itself, not the optical reticle. This is not a drawback since optical reticles are currently accepted as technical drawings by the Copyright Office.[283] In addition, the development of direct electron-beam mask writing will eliminate eventually the need for optical reticles.

The main problem with the bill as drafted is that it does not add any definition to itself. For example, what is to be the legal definition of "integrated circuit chips"?[284] Would it include hybrid circuits which

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[280]Conversation with Richard Glasgow, Office of the General Counsel, Copyright Office, Washington, D.C.

[281]H.R. 1007, 96th Cong., 1st Sess. (1979) was introduced by Congressman Edwards of California for himself, Congressman McCloskey, and Congressman Mineta, on January 18, 1979. The bill is now pending in the Subcommittee on Courts, Civil Liberties and the Administration of Justice of the Committee on the Judiciary. Conversation with Roberta Haberle, Congressman Edward's office.

[282]Mr. Borovoy of the Intel Corporation was a moving force in the drafting and introduction of the bill. *Id.*

[283]*See, e.g.*, the discussion of the *Intel* case, notes 272-81 *supra* and accompanying text.

[284]The bill is not even entirely self-consistent. The title of the bill refers to "semiconductor chips" while the text applies to "integrated circuit chips." In comcon parlance the two terms are used interchangeably, yet they represent different concepts. A "semiconductor chip" is a chip made of silicon, germanium, gallium arsenide, or any of a host of other materials delimited by *electrical* characteristics. An "integrated circuit chip" is a chip in or on which is constructed an "integrated circuit." An "integrated circuit" is not limited to the category of electronic devices. For example, in recent years the new field of integrated optics has emerged. These devics borrow concepts and techniques from semiconductor integrated circuits, yet function without electricity. Evidently, they would be protected as "integrated circuits," but not as "semiconductor chips."

are fabricated of several ICs and other components on a substrate? What if future technology does not use chips?[285] There is certainly no reason *not* to redraft the language to accommodate such future developments.

Another definition problem involves the word "imprint." The patterns which are created on IC chips are not "imprinted." "To imprint" is defined as "to mark by pressure, to impress; stamp; to delineate by pressure."[286] ICs are not made by "stamping" or "marking by pressure." It would be better to use a word which does not connote physical contact. The better choice may be to substitute "to fix," which already has a defined meaning,[287] which is flexible enough to include IC masks as well as future technology, and which is closer to physical reality.

On April 16, 1979, the House subcommittee[288] responsible for H.R. 1007 heard testimony and opinions of several major IC manufacturers,[289] and the Copyright Office.[290] It had been anticipated that the semiconductor companies would be uniform in their support of copyright protection of IC mask designs.[291] The IC manufacturers, however, unexpectedly split into opposing camps: two[292] gave support to H.R. 1007 while two voiced opposition to it.[293]

After a background exposition of the structure of the industry and the nature of the problem of protection, the proponents outlined their reasons for supporting the bill.[294] Their position was that reverse engi-

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[285]IBM, for example, is known to be developing a Josephson junction computer which is anything but a chip. This computer, a 2" x 2" x 2" cube, will contain 128 megabytes of memory, operate at 4° Kelvin, and be about 1,000 times faster than any present computer. It will not be made of a semiconductor material. *See* Electronic Engineering News, March 20, 1978.

Chip technology is basically a planar semiconductor technology. While it is economically an important technology now, it was nonexistent a little over twenty years ago. It is better to allow flexibility in the language to accomodate new technology. This is especially true when one compares the generational time of electronics to that of legislation.

[286]OXFORD ENGLISH DICTIONARY (compact ed. 1971).

[287]*See* 17 U.S.C. § 101 (1976).

[288]The Subcommittee on Courts, Civil Liberties and the Administration of Justice of the House Committee on the Judiciary. Electronic News, April 23, 1979, at 1, col. 1.

[289]Industry participants included Intel, Mostek, Fairchild Semiconductor, and National Semiconductor. *Id.*

[290]The Copyright Office was represented by Jon Baumgarten, General Counsel, Copyright Office, Washington, D.C.

[291]*Id.*

[292]Intel and Mostek supported H.R. 1007. *Id.*

[293]Fairchild Semiconductor and National Semiconductor opposed H.R. 1007. *Id.*

[294]The representative of Mostek, Mr. L.J. Sevin, first described the myriad applications of microelectronics and the size and structure of the world market. He described the manufacturing process. Speaking about the layout of the IC,

neering should be permitted, but direct copying proscribed.[205] They emphasized steadily increasing IC development costs and displayed photographs of chips actually copied by Japanese and Russian[206] IC manufacturers. One proponent submitted that H.R. 1007 would control copying through the necessity of licensing.[207]

The opponents countered that the effect of H.R. 1007 would be a reduction of the ability of IC manufacturers in the United States to compete in the world market and an increase in the cost of IC's to consumers.[208] Consumers benefitted from competition, hence competition in the form of direct copying should not be proscribed.[209] The op-

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he said, "[t]his is mostly done by hand, involving much trial-and-error and is one of the most difficult and time consuming parts of the development [of the IC]." Prepared Testimony of L.J. Sevin, Mostek Corporation. He emphasized the trend of increasing development costs in the semiconductor industry, especially in layout. Mr. Sevin outlined the qualities of a competent layout designer:

> Layout designers are creative persons and not just draftsmen. They must have some training in electronic circuitry, usually they are electronic technicians. They must have a strong ability to visualize from abstraction and must be able to plan ahead mentally much as a good chess player. The designer must be able to cram 70,000 or more transistors and their intricate rabbit-warren connections into an absolutely minimum area in order to minimize the chip size because that is directly related to cost. Layout design is a skill that has successfully resisted twelve years of attempts at computerization. It requires a level of human ingenuity that will not be computerized for at least another 25 years in my opinion, maybe longer—maybe never! *Id.*

According to Mr. Sevin, a 16K RAM which cost Mostek $3 million to develop can be copied in Japan in three months for $50,000.

An interesting question arises if one assumes that it is possible to computerize the layout of an IC. To be sure, many programs now exist which can layout a circuit completely. It is usually possible for a human to improve on the computer's design. This situation is much like that which now exists for computer chess programs. A good computer chess program can now beat all novice and intermediate players, as well as some more advanced players. If an IC maker were to develop his computer chip design program to the point where it no longer relied upon human supplementation, would the resulting chip layouts have the requisite "originality"? Would they be "founded in the creative power of the mind," and be "the fruits of intellectual labor"? Trade-Mark Cases, 100 U.S. 82, 84 (1879). This query is merely another formulation of a fundamental, though unanswered, question: What intellectual property protection, if any, should be accorded the products of that which is termed loosely "artificial intelligence"?

[205] *Id.*

[206] The Japanese company was Toshiba; the Russian copier was not identified. Prepared Testimony of A.S. Grove, Intel Corporation.

[207] *Id.*

[208] Prepared Testimony of J. Finch, National Semiconductor Corporation. In general, the cost of ICs has dropped consistently and dramatically since their introduction. Copying of masks, however, has become a problem only recently.

[209] While it may be true that consumers benefit from competition, Mr. Finch failed to answer the argument that sanctioning piracy would lead to fewer new ICs because developers would not be able to compete economically with mask pirates.

ponents noted that H.R. 1007 would work a basic change in the law, resulting for the first time in the protection of useful articles. Further, the 1976 Copyright Act and accompanying legislative history rejected such protection. The opponents drew an analogy between an IC and the end product of a numerically controlled machine tool.[300] Other asserted problems were the lack of extraterritorial effect of the copyright laws, [301] the lack of any guidance as to what constitutes "fair use" of a protected utilitarian object,[302] the fact that any new chip design would be protected regardless of its novelty and nonobviousness,[303] and the

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[300]This analogy is weak. If, for example, the lamp base statuettes in Mazer v. Stein, 347 U.S. 201 (1954), had been manufactured by a computer-controlled machine tool, they would still be copyrightable in their design. Copyright does not depend on the means of fabrication. The fact that a human being uses the intermediate step of a computer program to control the tool rather than his hands is irrelevant. It is the *character* of the end product, not the intervening process, that is important.

[301]This is a weak argument. It assumes that no other nations have or will have an interest in protecting the work product of their semiconductor companies. Moreover, problems of reciprocity of protection should be solved by treaty, not statute. Such problems alone should not be a barrier to protection. The argument of relative disadvantage in the world market could be used to attack many other areas of the law, *e.g.*, environmental legislation and shipping regulation. The goals, however, are still sound.

[302]There is no reason that lack of judicial gloss on "fair use" of such objects should be a significant obstacle to protection. Section 107 of the 1976 Copyright Act allows "fair use" of a copyrighted work for purposes of scholarship or research, among others. 17 U.S.C. § 107 (1976). "Section 107 is intended to restate the present judicial doctrine of fair use, not to change, narrow, or enlarge it in any way." House Copyright Report, *supra* note 187, at 66. Section 107 enumerates four factors to be considered in determining whether a use of a work is a "fair use." These factors include the purpose and character of the use, the nature of the copyrighted work, the amount and substantiality of the portion used in relation to the copyrighted work as a whole, and the effect of the use on the potential market for or the value of the copyrighted work. Applied to ICs, it appears that these factors leave ample room for legitimate reverse engineering, but proscribe direct copying for sale. Direct copying for reverse engineering purposes, however, would probably not infringe.

Assuming, *arguendo*, the underlying circuit is not otherwise protected, a competing IC maker could market legally a circuit which is a direct replacement of the developer's IC as long as it was not a direct copy of the developer's IC. Such marketing would have no legal effect on the potential market for or the value of the developer's IC within the meaning of the copyright law. As long as the competing IC maker copies the developer's IC only to learn the principles of its operation or for other research purposes, no infringement should result. Bare ideas are not protected under copyright. The competing IC maker would not have had the kind of adverse effect on the market for or the value of the IC that is protectable under the law.

[303]This criticism is totally inappropriate. Copyright protection has never been based on standards of novelty and nonobviousness, but on originality. *See* notes 161-77 *supra* and accompanying text.

inappropriate nature of copyright remedies to infringements involving mass-produced useful articles.[304]

The Copyright Office supported H.R. 1007. They had been at times uncertain whether masks conveyed "information" or were a mere "mechanical adjunct" to manufacturing ICs.[305] They noted the problems which result from relying on computer program copyright to protect mask designs.[306] The basic issues the Copyright Office felt that Congress should address were: (1) whether mask layout was in fact a creative choice and a means of expression not merely dictated by the chip's function, (2) whether existing protection under patent and copyright law

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[304]Patent remedies include injunction against future infringement (35 U.S.C. § 283 (1976)), assessment of at least a reasonable royalty which may be increased by the court up to treble damages (35 U.S.C. § 284 (1976)), and in eceptional cases, attorney fees (35 U.S.C. § 285 (1976)). Copyright remedies include injunction against future infringement (17 U.S.C. § 502(a)(1976)), impoundment and destruction of infringing articles and equipment used in the manufacture of infringing articles (17 U.S.C. § 503 (1976)), statutory or actual damages and profits (17 U.S.C. § 504 (1976)), attorney fees at the court's discretion (17 U.S.C. § 505 (1976)), and criminal penalties for willful infringement (17 U.S.C. § 506 (1976)).

The fact that different remedies are available under patent and copyright law has not been a substantial barrier to protection of other articles which may be protected under either law (*e.g.*, an object which could either be copyrighted or patented as a design). It is not clear that the mere difference in remedies would lead, as Mr. Finch claimed, to "a reduced rate of information exchange within the U.S. semiconductor industry. . . ." Prepared testimony of J. Finch, National Semiconductor Corporation.

[305]Prepared testimony of Jon Baumgarten, General Counsel, Copyright Office, Washington, D.C. The position of the Copyright Office was that IC masks and layouts embodied "original, creative intellectual effort," that the masks and layouts were "tangible representations" of the work of the layout designer, and that the particular layout of a given chip was not determined uniquely by the chip's function and represented the designer's choice. *Id.*

In fact, masks and reticles are both "information" to humans and "mechanical adjuncts" to the manufacturing process. The author personally has witnessed many designers who could deduce the underlying circuit from an inspection of a mask or mask set alone.

[306]The Copyright Office accepts computer programs for copyright. *See* note 153 *supra.* Under 37 C.F.R. § 202.20(c)(2) (vii) (1978), the Copyright Office requires a copy of the program "reproduced in a form visually perceptible without the aid of a machine or device, either on paper or in microform. . . ." *Id.* Even if the program contained in a ROM were protected, it is questionable that the chips themselves are protected as the expression of the underlying protected program. It is the essence of copyright that it protects the *form*, not the content, of the expression. If any protection is to be given to IC masks and reticles, it would be best to protect all parts of all ICs, not just those which contain a program. *See* notes 154-58 *supra* and accompanying text. As Mr. Baumgarten noted, protection only of the ROM portion of the chip would still permit copying of the unprotected remainder. The remainder frequently is the most valuable portion of the chip. Finally, the program copyright owner may not be the same person claiming rights in the mask layout.

was sufficient to protect against mask piracy, (3) whether copyright protection of ICs should be limited in term of protection, scope of exclusive rights, and remedies against infringements, (4) whether H.R. 1007 as drafted was technically accurate,[307] and (5) whether protection, if any, should be limited to those chips originating after the effective date of the amendment.

The representatives[308] of the subcommittee were perplexed by the unexpected split among IC manufacturers. It indeed is surprising that giants in the same industry who are all faced with the specter of formidable foreign competition should divide on the issue of protection of IC mask designs. In view of such lack of unanimity, it is very doubtful that H.R. 1007 will be passed in the near future.[309]

IV. CONCLUSION

The policy behind protection of IC reticles and masks is simple. As Justice Reed said in *Mazer v. Stein*,[310] "[s]acrificial days devoted to such creative activities deserve rewards commensurate with the services rendered."[311] An IC maker who invests millions in chip development should not be divested of his just rewards by the blatant copying of his effort. It is the labor invested which deserves protection.

It is obvious from the above examination of the possible modes of intellectual property protection that problems abound in each for IC masks and reticles. Yet IC makers need protection now. The need will be even greater in the future as increased chip complexity makes appropriation proportionately more profitable to a pirate.

What protection is needed? First, whatever protection is given should take effect immedaitely upon the fixing of the reticle but should be limited in duration. The IC market is fast moving, and what is most valuable to the manufacturer who would introduce a new chip is "lead

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[307]*See, e.g.*, notes 284-87 *supra* and accompanying text. In particular, the Copyright Office noted the possible difference in interpretation of "semiconductor chips" and "integrated circuit chips." Further, "imprinted patterns" could be interpreted to mean "surface appearance" or "sub-surface configurations." Prepared Testimony of Jon Baumgarten, General Counsel, Copyright Office, Washington, D.C.

[308]The hearings were attended by Representatives Mineta and Edwards of California and Representative Kastenmeier of Wisconsin. Electronic News, April 23, 1979, at 1, col. 1.

[309]According to Representative Edwards, "We've certainly not come far enough in the hearing to even come close to a definitive answer." *Id.* This opinion is shared by some in the Copyright Office. Conversation with Richard Glasgow, Office of the General Counsel, Copyright Office, Washington, D.C.

[310]347 U.S. 201 (1954).

[311]*Id.* at 219.

time" over competitors.[312] On the other hand, electronic technology changes quite rapidly. The duration of a "generation" in electronics is on the order of two years. Protection for this period or perhaps a bit longer would be appropriate. Patent protection lasts 17 years,[313] copyright lasts for 75 years from the year of first publication, or 100 years from the year of creation, whichever expires first.[314] These figures are certainly on the generous side. The opposing public interest in fostering competition dictates that the period of protection be as short as reasonably will insure an incentive for the IC makers to invest in research and development. A limited period of protection will put the masks in the public domain earlier. This can be advantageous especially for newcomers to the IC industry who may have little capital,[315] and who must depend on "second-sourcing" of other manufacturer's circuits for their initial success.

Second, the protection given to IC makers should protect innovators, or improvers, but not copiers. No liability should result if an IC maker microphotographs his competitor's chip, "reverse engineers" the chip back to the original circuit, then lays out the circuit anew. This is different from bare copying—the labor invested is substantial, and the newly laid-out chip will be optimized for the improver's process. The policy of providing the best product at the lowest cost would allow improvements such as this. However, extremely minor improvements or facial differences calculated to insulate from liability should not be allowed.

Third, protection given to IC makers certainly should borrow from current patent and copyright tenets that not only must there be a minimally sufficient intellectual effort displayed in the mask, but also that no protection should be given if only a few ways of laying out the mask exist. The former would exclude most small circuits and larger circuits now in the public domain. The latter would protect against monopoly of an idea, and leave room for improvement by "designing around" protected designs.

Finally, in view of the relative rates of change of IC technology

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[312]CONTU Meeting No. 19, *supra* note 28, at 40.

[313]35 U.S.C. § 154 (1976).

[314]17 U.S.C. § 302(c) (1976). This section requires that the work be an anonymous work, a pseudonymous work, or a work made for hire. Most integrated circuits are "made for hire" and would fall under this section.

[315]Capital investment to start an IC facility can be quite substantial—on the order of $5 to $10 million. In the 1980s as electron-beam lithography and X-ray projection become common, costs may rise substantially. *See* MacKintosh, *A Prognosis of the Intercontinental LSI Battle*, DIGEST OF TECHNICAL PAPERS, IEEE Solid State Circuits Conference, San Francisco, California, February 15, 1978.

and of the copyright law, protection should be flexible enough to cover not only present technologies, but future technologies as well. H.R. 1007 falls far short of this mark.[316] Protection should not be cast in terms of specific methods, products, or processes but instead should address the crux of the issue: protection of complex technical designs which represent a creative choice from among alternatives not dictated by the end function of the object in which they are embodied.

Of all present modes of protection, copyright is the obvious choice. Copyright protects the form, but not the content, of the idea. For IC makers, form is exactly what needs protection; ideas should not be protected. Copyright takes effect immediately upon fixing; there is no need to wait for cumbersome approaval or certification proceedings. Copyright also will yield, if no alternative in circuit layout exists, to admit a perfect, but unavoidable, copy. Moreover, should an IC maker happen to make a perfect copy innocently, there would be no liability. The major barrier to copyrightability presently is the "useful articles" doctrine.[317] This doctrine could be relaxed for specific cases such as ICs.[318] Copyright requires no detailed disclosure since the mask "describes itself." The protection granted under copyright is far too long, but could be shortened to reflect more accurately the duration of needed protection. Finally, and most important from a practical standpoint, a copyright is statistically far more likely to be validated in court than is, say, a patent.[319]

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[316]*See, e.g.*, notes 280-86, 307 *supra*.

[317]This barrier exists if one insists on considering IC masks as "pictorial, graphic, or sculptural works." An IC mask *set* viewed as an "audiovisual work" would not fall under the useful articles doctrine, which as now codified, only applies to "pictorial, graphic, or sculptural works." Nor would such categorization be a detriment wince IC mask sets are valuable primarily as a *set*, not as individual masks.

[318]One should think twice about this. Printed circuit boards are manufactured by a photo-process similar to that used in the manufacture of ICs and also require an enormous development effort. In fact, one could view the aluminum metallization pattern on ICs, which connects the various components, as a miniature printed circuit. Should printed circuits be included too? Would this turn the copyright laws into industrial design protection laws? If so, then should the problem be reconsidered *in toto* from a global perspective rather than on a point-by-point basis?

[319]In the Supreme Court, one stands about a 14% chance of having a patent validated, judging from patent cases tried there between 1881 and 1945. Kenyon, *Patent Law: Why Challenge the Courts View of Invention?*, 35 A.B.A.J. 480 (1949). In the Courts of Appeal, chances improves to about 60%. Silverman, *The Copyright Halo: A Comparison of Judicial Standards for Copyrights and Patents*, 23 U. PITT. L. REV. 137, 144 (1961). For copyrights, the odds improve to around 80% in the courts. *Id.*

APPENDIX 4.—TEXT OF BILLS

A.

98TH CONGRESS
2D SESSION

H. R. 5525

To amend title 17, United States Code, to protect mask works of semiconductor chips against unauthorized duplication, and for other purposes.

IN THE HOUSE OF REPRESENTATIVES

APRIL 26, 1984

Mr. EDWARDS of California (for himself, Mr. RODINO, Mr. MINETA, Mr. KASTENMEIER, Mr. AUCOIN, Mr. BADHAM, Mr. BERMAN, Mr. BOEHLERT, Mr. BOSCO, Mrs. BOXER, Mr. BROOKS, Mr. BROWN of California, Mr. CHANDLER, Mr. CHAPPIE, Mr. CLINGER, Mr. CONYERS, Mr. DEWINE, Mr. ERLENBORN, Mr. FAZIO, Ms. FIEDLER, Mr. FISH, Mr. FRANK, Mr. GEKAS, Mr. GLICKMAN, Mr. HAWKINS, Mr. HYDE, Mr. JEFFORDS, Mrs. JOHNSON, Mr. KINDNESS, Mr. LAFALCE, Mr. LANTOS, Mr. LEHMAN of Florida, Mr. LEVINE of California, Mr. LOWERY of California, Mr. LUJAN, Mr. MCCAIN, Mr. MCCOLLUM, Mr. MARTINEZ, Mr. MAZZOLI, Mr. MOORHEAD, Mr. MORRISON of Connecticut, Mr. MRAZEK, Mr. MURPHY, Mr. NELSON of Florida, Mr. OLIN, Mr. OWENS, Mr. PANETTA, Mr. PRITCHARD, Mr. REID, Mr. RICHARDSON, Mr. RITTER, Mr. RUDD, Mr. SAWYER, Mrs. SCHNEIDER, Mrs. SCHROEDER, Mr. SENSENBRENNER, Mr. ROBERT F. SMITH, Mr. STARK, Mr. SYNAR, Mr. TORRES, Mr. WAXMAN, Mr. WYDEN, and Mr. ZSCHAU) introduced the following bill; which was referred to the Committee on the Judiciary

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A BILL

To amend title 17, United States Code, to protect mask works of semiconductor chips against unauthorized duplication, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

30-425 O—84——29

SHORT TITLE

SECTION 1. This Act may be cited as the "Semiconductor Chip Protection Act of 1984".

PROTECTION OF SEMICONDUCTOR CHIP PRODUCTS

SEC. 2. Title 17, United States Code, is amended by adding at the end thereof the following new chapter:

"CHAPTER 9—PROTECTION OF SEMICONDUCTOR CHIP PRODUCTS

"§901. Definitions

"As used in this chapter—

"(1) a 'semiconductor chip product' is the final or intermediate form of any product—

"(A) having two or more layers of metallic, insulating, or semiconductor material deposited or otherwise placed on, or etched away or otherwise removed from, a piece of semiconductor material in accordance with a predetermined pattern; and

"(B) that is intended to perform electronic circuitry functions;

"(2) a 'mask work' means the 2-dimensional and 3-dimensional features of shape, pattern, and configuration of the surface of the layers of a semiconductor chip product, regardless of whether such features have an intrinsic utilitarian function that is not only to portray the appearance of the product or to convey information;

"(3) a mask work is 'fixed' in a semiconductor chip product when its embodiment in the product, by or under the authority of the owner of the mask work, is sufficiently permanent or stable to permit the mask work to be perceived, reproduced, or otherwise communicated for a period of more than transitory duration;

"(4) a mask work is 'original' if it is the independent creation of an author who did not copy it from another source;

"(5) to 'commercially exploit' a mask work is to sell, offer for sale after the mask work is fixed in a semiconductor chip product, or otherwise distribute to the public for profit semiconductor chip products embodying the mask work;

"(6) the 'owner' of a mask work is the author of the mask work, the legal representatives of a deceased author or of an author under a legal incapacity, the employer for whom the author created the mask work in the case of a work made within the scope of the author's employment, or a person to whom the rights of the author or of such employer are transferred in accordance with this chapter;

"(7) an 'innocent purchaser' is a person who purchases a semiconductor chip product in good faith and without having notice of protection with respect to that semiconductor chip product;

"(8) having 'notice of protection' means having actual knowledge that, or reasonable grounds to believe that, a mask work fixed in a semiconductor chip product is protected under this chapter; and

"(9) an 'infringing semiconductor chip product' is a semiconductor chip product which is made, imported, or distributed in violation of the exclusive rights of the owner of a mask work under this chapter.

"§902. Subject matter of protection

"(a)(1) An original mask work fixed in a semiconductor chip product is eligible for protection under this chapter if—

"(A) on the date on which the mask work is registered under section 908, or the date on which the mask work is first commercially exploited, whichever occurs first, the owner of the mask work is a national or domiciliary of the United States, or is a national, domiciliary, or sovereign authority of a foreign nation that is a party to a treaty affording protection to mask works to which the United States is also a party, or is a stateless person, wherever that person may be domiciled;

"(B) the mask work is first commercially exploited in the United States; or

"(C) the mask work comes within the scope of a Presidential proclamation issued under paragraph (2).

"(2) Whenever the President finds that a foreign nation extends, to mask works of owners who are nationals or domiciliaries of the United States or to mask works on the date on which the mask works are registered under section 908, or the date on which the mask works are first commercially exploited, whichever occurs first, protection (A) on substantially the same basis as that on which the foreign nation extends protection to mask works of its own nationals and domiciliaries and mask works first commercially exploited in that nation, or (B) on substantially the same basis as provided in this chapter, the President may by proclamation extend protection under this chapter to mask works (i) of owners who are, on the date on which the mask works are registered under section 908, or the date on which the mask works are first commercially exploited, whichever occurs first, nationals, domiciliaries, or sovereign authorities of that nation, or (ii) which are first commercially exploited in that nation.

"(b) Protection under this chapter shall not be available for a mask work that—

"(1) is not original; or

"(2) consists of designs that are staple, commonplace, or familiar in the semiconductor industry, or variations of such designs, combined in a way that is not original.

"(c) In no case does protection under this chapter for a mask work extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied in such work.

"§903. Ownership and transfer

"(a) The exclusive rights in a mask work subject to protection under this chapter shall vest in the owner of the mask work.

"(b) The exclusive rights in a mask work registered under section 908, or a mask work for which an application for registration has been or is eligible to be filed under section 908, may be transferred in whole or in part by any means of conveyance or by operation of law, and may be bequeathed by will or pass as personal property by the applicable laws of intestate succession.

"(c) In any case in which conflicting transfers of the exclusive rights in a mask work are made, the transfer first executed shall be void as against a subsequent transfer which is made for a valuable consideration and without notice of the first tranfer, unless the first transfer is recorded in the Copyright Office within three months after the date on which it is executed, but in no case later than the day before the date of such subsequent transfer.

"(d) Mask works prepared by an officer or employee of the United States Government as part of that person's official duties are not protected under this chapter, but the United States Government is not precluded from receiving and holding exclusive rights in mask works transferred to the Government under subsection (b).

"§904. Duration of protection

"(a) The protection provided for a mask work under this chapter shall commence on the date on which the mask work is registered under section 908, or the date on which the mask work is first commercially exploited, whichever occurs first.

"(b) Subject to the provisions of this chapter, the protection provided under this chapter to a mask work shall continue for a term of ten years beginning on the date on which such protection commences under subsection (a).

"§905. Exclusive rights in mask works

"Subject to the other provisions of this chapter, the owner of a mask work has the exclusive rights to do and to authorize any of the following:

"(1) to reproduce the mask work by optical, electronic, or any other means;

"(2) to import or distribute a semiconductor chip product in which the mask work is embodied; and

"(3) to induce or knowingly to cause another person to do any of the acts described in paragraphs (1) and (2).

"§906. Limitation on exclusive rights: reverse engineering; first sale

"(a) Notwithstanding the provisions of section 905(1), it is not an infringement of the exclusive rights of the owner of a mask work to reproduce the work solely for the purpose of teaching, analyzing, or evaluating the concepts or techniques embodied in the mask work or the circuitry or organization of components used in the mask work.

"(b) Notwithstanding the provisions of section 905(2), the owner of a particular semiconductor chip product lawfully made under this chapter, or any person authorized by such owner, is entitled, without the authority of the owner of the mask work, to sell or otherwise dispose of that semiconductor chip product.

"§907. Limitation on exclusive rights: innocent infringement

"(a) Notwithstanding any other provision of this chapter, an innocent purchaser of an infringing semiconductor chip product—

"(1) shall incur no liability under this chapter with respect to the distribution of units of the infringing semiconductor chip product that occurred before that innocent purchaser had notice of protection with respect to that semiconductor chip product; and

"(2) shall be liable only for a reasonable royalty on each unit of the infringing semiconductor chip product that the innocent purchaser distributed after having notice of protection with respect to that semiconductor chip product, the amount of the royalty to be determined by voluntary negotiation between the parties, mediation, or binding arbitration, or, if the parties do not resolve the issue, by the court in a civil action for infringement.

"(b) The immunity from liability and limitation on liability referred to in subsection (a) shall apply to any person who directly or indirectly purchases an infringing semiconductor chip product from an innocent purchaser.

"(c) The provisions of subsections (a) and (b) apply only with respect to units of an infringing semiconductor chip product that an innocent purchaser purchased before having notice of protection with respect to that semiconductor chip product.

"§908. Registration of claims of protection

"(a) Protection of a mask work under this chapter shall terminate if application for registration of a claim of protection in the mask work is not made as provided by this chapter within two years after the date on which the mask work is first commercially exploited.

"(b) The Register of Copyrights shall be responsible for all administrative functions and duties under this chapter. Except for section 708, the provisions of chapter 7 of this title relating to the general responsibilities, organization, regulatory authority, actions, records, and publications of the Copyright Office shall apply to this chapter, except that the Register of Copyrights may make such changes as may be necessary in applying those provisions to this chapter.

"(c) The application for registration of a mask work shall be made on a form prescribed by the Register of Copyrights and shall include any information regarded by the Register of Copyrights as bearing upon the preparation or identification of the work, the existence or duration of protection, or ownership of the work.

"(d) The Register of Copyrights shall by regulation set reasonable fees for the filing of applications to register claims of protection in mask works under this chapter, and for other services relating to the administration of this chapter or the rights under this chapter, taking into consideration the cost of providing those services, the benefits of a public record, and statutory fee schedules under this title. The Register shall also specify the identifying material to be deposited in connection with the claim for registration.

"(e) If the Register of Copyrights, after examining an application for registration, determines, in accordance with the provisions of this chapter, that the application relates to a mask work which warrants protection under this chapter, then the Register shall register the claim and issue to the applicant a certificate of registration of the claim under the seal of the Copyright Office. The effective date of registration of a claim of protection shall be the date on which an application, deposit, and fee, which are determined by the Register of Copyrights or by a court of competent jurisdiction to be acceptable for registration, have all been received in the Copyright Office.

"(f) In any action for infringement under this chapter, the certificate of registration of a mask work shall constitute prima facie evidence (1) of the facts stated in the certificate, and (2) that the applicant issued the certificate has met the requirements of this chapter, and the regulations issued under this chapter, with respect to the registration of claims.

"(g) Any applicant for registration under this section who is dissatisfied with the refusal of the Register of Copyrights to issue a certificate of registration under this section may seek judicial review of that refusal by bringing an action for such review in an appropriate United States district court, in accordance with chapter 7 of title 5, not later than sixty days after the refusal. The failure of the Register of Copyrights to issue a certificate of registration within three months after an application for registration is filed shall be deemed to be a refusal to issue a certificate of registration for purposes of this subsection and section 910(c).

"§909. Mask work notice

"(a) The owner of a mask work provided protection under this chapter may affix notice to the mask work or to the semiconductor chip product embodying the mask work in such manner and location as to give reasonable notice of such protection. The Register of Copyrights shall prescribe by regulation, as examples, specific methods of affixation and positions of notice for purposes of this section, but these specifications shall not be considered exhaustive. The affixation of such notice is not a condition of protection under this chapter, but shall constitute prima facie evidence of notice of protection.

"(b) The notice referred to in subsection (a) shall consist of—

"(1) the words 'mask work', or the letter M in a circle Ⓜ;

"(2) the year in which the mask work was first fixed in a semiconductor chip product; and

"(3) the name of the owner or owners of the mask work or an abbreviation by which the name is recognized or is generally known.

"§910. Enforcement of exclusive rights

"(a) Except as otherwise provided by this chapter, any person who violates any of the exclusive rights of the owner of a mask work under this chapter shall be liable as an infringer of such rights.

"(b) The owner of a mask work protected under this chapter shall be entitled to institute a civil action for infringement after a certificate of registration of a claim in that mask work is issued under section 908.

"(c) In any case in which an application for registration and the required deposit and fee have been received in the Copyright Office in proper form and registration of the mask work has been refused, the applicant is entitled to institute a civil action for infringement under this chapter if notice of the action, together with a copy of the complaint, is served on the Register of Copyrights, in accordance with the Federal Rules of Civil Procedure. The Register may, at his or her option, become a party to the action with respect to the issue of whether the claim is eligible for registration by entering an appearance within sixty days after such service, but the failure of the Register to become a party to the action shall not deprive the court of jurisdiction to determine that issue.

"(d)(1) The Secretary of the Treasury and the United States Postal Service shall separately or jointly issue regulations for the enforcement of the right to import set forth in section 905. These regulations may require, as a condition for the exclusion of articles from the United States, that the person seeking exclusion—

"(A) obtain a court order enjoining, or an order of the International Trade Commission under section 337 of the Tariff Act of 1930 excluding, importation of the articles; or

"(B) furnish proof that the mask work involved is protected under this chapter and that the importation of the articles would infringe the rights in the mask work under this chapter, and also post a surety bond for any injury that may result if the detention or exclusion of the articles proves to be unjustified.

"(2) Articles imported in violation of the right to import set forth in section 905 are subject to seizure and forfeiture in the same manner as property imported in violation of the customs laws. Any such forfeited articles shall be destroyed as directed by the Secretary of the Treasury or the court, as the case may be, except that the articles may be returned to the country of export whenever it is shown to the satisfaction of the Secretary of the Treasury that the importer had no reasonable grounds for believing that his or her acts constituted a violation of the law.

"§911. Remedies for infringement

"(a) Any court having jurisdiction of a civil action arising under this chapter may grant temporary and permanent injunctions on such terms as the court may deem reasonable to prevent or restrain infringement of the exclusive rights in a mask work under this chapter.

"(b) Upon finding for the owner of the mask work, the court shall award the owner actual damages suffered by the owner as a result of the infringement. The court shall also award the owner the infringer's profits that are attributable to the infringement and are not taken into account in computing the award of actual damages. In establishing the infringer's profits, the owner of the mask work is required to present proof only of the infringer's gross revenue, and the infringer is required to prove his or her deductible expenses and the elements of profit attributable to factors other than the mask work.

"(c) At any time before final judgment is rendered, the owner of the mask work may elect, instead of actual damages and profits as provided by subsection (b), an award of statutory damages for all infringements involved in the action, with respect to any one mask work for which any one infringer is liable individually, or for which any two or more infringers are liable jointly and severally, in an amount not more than $250,000 as the court considers just.

"(d) In any action for infringement under this chapter, the court in its discretion may allow the recovery of full costs, including reasonable attorneys' fees, to the prevailing party.

"(e) An action for infringement under this chapter shall not be maintained unless the action is commenced within three years after the claim accrues.

"(f) As part of a final judgment or decree, the court may order the destruction or other disposition of any infringing semiconductor chip products, and any masks, tapes, or other articles by means of which such products may be reproduced.

"§912. Relation to other laws

"(a) Nothing in this chapter shall affect any right or remedy held by any person under chapters 1 through 8 of this title, or under title 35.

"(b) Except as provided in section 908(b) of this title, references to 'this title' or 'title 17' in chapters 1 through 8 of this title shall be deemed not to apply to this chapter.

"(c) The provisions of this chapter shall preempt the laws of any State to the extent those laws provide any rights or remedies with respect to a mask work which are equivalent to those provided by this chapter, except that such preemption shall be effective only with respect to actions filed on or after January 1, 1986.

"(d) The provisions of sections 1338, 1400(a), and 1498(b) and (c) of title 28 shall apply to exclusive rights in mask works under this chapter.".

TECHNICAL AMENDMENT

SEC. 3. The table of chapters of title 17, United States Code, is amended by adding at the end thereof the following new item:

"9. Protection of Semiconductor Chip Products. . . 901".

EFFECTIVE DATE

SEC. 4. (a) The amendments made by this Act shall take effect on January 1, 1985.

(b)(1) Subject to paragraph (2) of this subsection, protection shall be available under chapter 9 of title 17, United States Code, as added by section 2 of this Act, to any mask work fixed in a semiconductor chip product that was first commercially exploited on or after January 1, 1984, and before January 1, 1985, if a claim of protection in the mask work is registered in the Copyright Office before January 1, 1986, under section 908 of title 17, United States Code, as added by section 2 of this Act.

(2) In the case of any mask work provided protection under chapter 9 of title 17, United States Code, in accord-

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ance with paragraph (1) of this subsection, any infringing semiconductor chip products manufactured before the effective date of this Act may be imported into or distributed in the United States, or both, subject to the payment by the importer or distributor, as the case may be, of the reasonable royalty specified in section 907(a)(2) of title 17, United States Code, as added by section 2 of this Act.

(3) For purposes of this subsection, the terms "mask work", "fixed", "semiconductor chip product", "commercially exploited", and "infringing semiconductor chip product" have the meanings given those terms in section 901 of title 17, United States Code, as added by section 2 of this Act.

AUTHORIZATION OF APPROPRIATIONS

SEC. 5. There are authorized to be appropriated such sums as may be necessary to carry out this Act and the amendments made by this Act.

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98TH CONGRESS
1ST SESSION

H. R. 2985

To amend the copyright law, title 17 of the United States Code, to provide for protection of ornamental designs of useful articles.

IN THE HOUSE OF REPRESENTATIVES

MAY 11, 1983

Mr. MOORHEAD introduced the following bill; which was referred to the Committee on the Judiciary

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A BILL

To amend the copyright law, title 17 of the United States Code, to provide for protection of ornamental designs of useful articles.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. Title 17, United States Code, is amended by adding at the end thereof the following new chapter:

"CHAPTER 9—PROTECTION OF ORNAMENTAL DESIGNS OF USEFUL ARTICLES

"Sec.

"DESIGNS PROTECTED

"SEC. 901. (a) The author or other proprietor of an original ornamental design of a useful article may secure the protection provided by this chapter upon complying with and subject to the provisions hereof.

"(b) For the purposes of this chapter—

"(1) A 'useful article' is an article which in normal use has an intrinsic utilitarian function that is not merely to portray the appearance of the article or to convey information. An article which normally is a part of a useful article shall be deemed to be a useful article.

"(2) The 'design of a useful article', hereinafter referred to as a 'design', consists of those aspects or elements of the article, including its two-dimensional or three-dimensional features of shape and surface, which make up the appearance of the article. The design must be fixed in a useful article to be protectable under this chapter.

"(3) A design is 'ornamental' if it is intended to make the article attractive or distinct in appearance to the purchasing or using public.

"(4) A design is 'original' if it is the independent creation of an author who did not copy it from another source.

"DESIGNS NOT SUBJECT TO PROTECTION

"SEC. 902. Protection under this chapter shall not be available for a design that is—

"(a) not original;

"(b) staple or commonplace, such as a standard geometric figure, familiar symbol, emblem, or motif, or other shape, pattern, or configuration which has become common, prevalent, or ordinary;

"(c) different from a design excluded by subparagraph (b) above only in insignificant details or in elements which are variants commonly used in the relevant trades;

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"(d) dictated solely by a utilitarian function of the article that embodies it; or

"(e) composed of three-dimensional features of shape and surface with respect to men's, women's, and children's apparel, including undergarments and outerwear.

"REVISIONS, ADAPTATIONS, AND REARRANGEMENTS

"SEC. 903. Protection for a design under this chapter shall be available notwithstanding the employment in the design of subject matter excluded from protection under section 902 (b) through (d), if the design is a substantial revision, adaptation, or rearrangement of said subject matter: *Provided,* That such protection shall be available to a design employing subject matter protected under chapters 1 through 8 of this title, or title 35 of the United States Code or this chapter, only if such protected subject matter is employed with the consent of the proprietor thereof. Such protection shall be independent of any subsisting protection in subject matter employed in the design, and shall not be construed as securing any right to subject matter excluded from protection or as extending any subsisting protection.

"COMMENCEMENT OF PROTECTION

"SEC. 904. The protection provided for a design under this chapter shall commence upon the date of publication of the registration pursuant to section 912(a) or the date the design is first made public as defined by section 909(b), whichever occurs first.

"TERM OF PROTECTION

"SEC. 905. (a) Subject to the provisions of this chapter, the protection herein provided for a design shall continue for a term of ten years from the date of the commencement of protection as provided in section 904.

"(b) Upon expiration or termination of protection in a particular design as provided in this chapter all rights under this chapter in said design shall terminate, regardless of the number of different articles in which the design may have been utilized during the term of its protection.

"THE DESIGN NOTICE

"SEC. 906. (a) Whenever any design for which protection is sought under this chapter is made public as provided in section 909(b), the proprietor shall, subject to the provisions of section 907, mark it or have it marked legibly with a design notice consisting of the following three elements:

"(1) the words 'Protected Design', the abbreviation 'Prot'd Des.', or the letter 'D' with a circle thus Ⓓ;

"(2) the year of the date on which protection for the design commenced; and

"(3) the name of the proprietor, an abbreviation by which the name can be recognized, or a generally accepted alternative designation of the proprietor; any distinctive identification of the proprietor may be used if it has been approved and recorded by the Administrator before the design marked with such identification is registered.

After registration the registration number may be used instead of the elements specified in (2) and (3) hereof.

"(b) The notice shall be so located and applied as to give reasonable notice of design protection while the useful article embodying the design is passing through its normal channels of commerce. This requirement may be fulfilled, in the case of sheetlike or strip materials bearing repetitive or continuous designs, by application of the notice to each repetition, or to the margin, selvage, or reverse side of the material at reasonably frequent intervals, or to tags or labels affixed to the material at such intervals.

"(c) When the proprietor of a design has complied with the provisions of this section, protection under this chapter shall not be affected by the removal, destruction, or obliteration by others of the design notice on an article.

"EFFECT OF OMISSION OF NOTICE

"SEC. 907. The omission of the notice prescribed in section 906 shall not cause loss of the protection or prevent recovery for infringement against any person who, after written notice of the design protection, begins an undertaking leading to infringement: *Provided,* That such omission shall prevent any recovery under section 922 against a person who began an undertaking leading to infringement before receiving written notice of the design protection, and no injunction shall be had unless the proprietor of the design shall reimburse said person for any reasonable expenditure or contractual obligation in connection with such undertaking incurred before written notice of design protection, as the court in its discretion shall direct. The burden of providing written notice shall be on the proprietor.

"INFRINGEMENT

"SEC. 908. (a) It shall be infringement of a design protection under this chapter for any person, without the consent of the proprietor of the design, within the United States or its territories or possessions and during the term of such protection, to—

"(1) make, have made, or import, for sale or for use in trade, any infringing article as defined in subsection (d) hereof; or

"(2) sell or distribute for sale or for use in trade any such infringement article: *Provided, however,* That a seller or distributor of any such article who did not make or import the same shall be deemed to be an infringer only if—

"(i) he induced or acted in collusion with a manufacturer to make, or an importer to import such article (merely purchasing or giving an order to purchase in the ordinary course of business shall not of itself constitute such inducement or collusion); or

"(ii) he refuses or fails upon the request of the proprietor of the design to make a prompt and full disclosure of his source of such article, and he orders or reorders such article after having received notice by registered or certified mail of the protection subsisting in the design.

"(b) It shall not be infringement to make, have made, import, sell, or distribute, any article embodying a design created without knowledge of, and copying from, a protected design.

"(c) A person who incorporates into his own product of manufacture an infringing article acquired from others in the ordinary course of business, or who, without knowledge of the protected design, makes or processes an infringing article for the account of another person in the ordinary course of business, shall not be deemed an infringer except under the conditions of clauses (i) and (ii) of paragraph (a)(2) of this section. Accepting an order or reorder from the source of the infringing article shall be deemed ordering or reordering within the meaning of clause (ii) of paragraph (a)(2) of this section.

"(d) An 'infringing article' as used herein is any article, the design of which has been copied from the protected design, without the consent of the proprietor: *Provided, however,* That an illustration or picture of a protected design in an advertisement, book, periodical, newspaper, photograph, broadcast, motion picture, or similar medium shall not be deemed to be an infringing article. An article is not an infringing article if it embodies, in common with the protected design, only elements described in subsections (a) through (d) of section 902.

"(e) The party alleging rights in a design in any action or proceeding shall have the burden of affirmatively establishing its originality whenever the opposing party introduces an earlier work which is identical to such design, or so similar as to make a prima facie showing that such design was copied from such work.

"APPLICATION FOR REGISTRATION

"SEC. 909. (a) Protection under this chapter shall be lost if application for registration of the design is not made within six months after the date on which the design was first made public.

"(b) A design is made public when, by the proprietor of the design or with his consent, an existing useful article embodying the design is anywhere publicly exhibited, publicly distributed, or offered for sale or sold to the public.

"(c) Application for registration or renewal may be made by the proprietor of the design.

"(d) The application for registration shall be made to the Administrator and shall state (1) the name and address of the author or authors of the design; (2) the name and address of the proprietor if different from the author; (3) the specific name of the article, indicating its utility; (4) the date, if any, that the design was first made public, if such date was earlier than the date of application; (5) affirmation that the design has been fixed in a useful article; and (6) such other information as may be required by the Administrator. The application for registration may include a description setting forth the salient features of the design, but the absence of such a description shall not prevent registration under this chapter.

"(e) The application for registration shall be accompanied by a statement under oath by the applicant or his duly authorized agent or representative, setting forth that, to the best of his knowledge and belief (1) the design is original and was created by the author or authors named in the application; (2) the design has not previously been registered on behalf of the applicant or his predecessor in title; and (3) the applicant is the person entitled to protection and to registration under this chapter. If the design has been made public with the design notice prescribed in section 906, the statement shall also describe the exact form and position of the design notice.

"(f) Error in any statement or assertion as to the utility of the article named in the application, the design of which is sought to be registered shall not affect the protection secured under this chapter.

"(g) Errors in omitting a joint author or in naming an alleged joint author shall not affect the validity of the registration, or the actual ownership or the protection of the design: *Provided,* That it is shown that the error occurred without deceptive intent. Where the design was made within the regular scope of the author's employment and individual authorship of the design is difficult or impossible to ascribe and the application so states, the name and address of the employer for whom the design was made may be stated instead of that of the individual author.

"(h) The application for registration shall be accompanied by two copies of a drawing or other pictorial representation of the useful article having one or more views, adequate to show the design, in a form and style suitable for reproduction, which shall be deemed a part of the application.

"(i) Where the distinguishing elements of a design are in substantially the same form in a number of different useful articles, the design shall be protected as to all such articles when protected as to one of them, but not more than one registration shall be required.

"(j) More than one design may be included in the same application under such conditions as may be prescribed by the Administrator. For each design included in an application the fee prescribed for a single design shall be paid.

"BENEFIT OF EARLIER FILING DATE IN FOREIGN COUNTRY

"SEC. 910. An application for registration of a design filed in this country by any person who has, or whose legal representative or predecessor or successor in title has previously regularly filed an application for registration of the same design in a foreign country which affords similar privileges in the case of application filed in the United States or to citizens of the United States shall have the same effect as if filed in this country on the date on which the application was first filed in any such foreign country, if the application in this country is filed within six months from the earliest date on which any such foreign application was filed.

"OATHS AND ACKNOWLEDGMENTS

"SEC. 911. (a) Oaths and acknowledgments required by this chapter may be made before any person in the United States authorized by law to administer oaths, or, when made in a foreign country, before any diplomatic or consular officer of the United States authorized to administer oaths, or before any official authorized to administer oaths in the foreign country concerned, whose authority shall be proved by a certificate of a diplomatic or consular officer of the United States, and shall be valid if they comply with the laws of the state or country where made.

"(b) The Administrator may by rule prescribe that any document to be filed in the Office of the Administrator and which is required by any law, rule, or other regulation to be under oath may be subscribed to by a written declaration in such form as the Administrator may prescribe, such declaration to be in lieu of the oath otherwise required.

"(c) Whenever a written declaration as permitted in subsection (b) is used, the document must warn the declarant that willful false statements and the like are punishable by fine or imprisonment, or both (18 U.S.C. 1001) and may jeopardize the validity of the application or document or a registration resulting therefrom.

"EXAMINATION OF APPLICATION AND ISSUE OR REFUSAL OF REGISTRATION

"SEC. 912. (a) Upon the filing of an application for registration in proper form as provided in section 909, and upon payment of the fee provided in section 915, the Administrator shall determine whether or not the application relates to a design which on its face appears to be subject to protection under this chapter, and if so the Administrator shall register the design. Registration under this subsection shall be announced by publication. The date of registration shall be the date of publication.

"(b) If, in the judgment of the Administrator, the application for registration relates to a design which on its face is not subject to protection under this chapter, the Administrator shall send the applicant a notice of refusal to register and the grounds therefor. Within three months from the date the notice of refusal is sent, the applicant may request, in writing, reconsideration of his application. After consideration of such a request, the Administrator shall either register the design or send the applicant a notice of final refusal to register.

"(c) Any person who believes he is or will be damaged by a registration under this chapter may, upon payment of the prescribed fee, apply to the Administrator at any time to cancel the registration on the ground that the design is not subject to protection under the provisions of this chapter, stating the reasons therefor. Upon receipt of an application for cancellation, the Administrator shall send the proprietor of the design, as shown in the records of the Office of the Administrator, a notice of said application, and the proprietor shall have a period of three months from the date such notice was mailed in which to present arguments in support of the validity of the registration. It shall also be within the authority of the Administrator to establish, by regulation, conditions under which the opposing parties may appear and be heard in support of their arguments. If, after the periods provided for the presentation of arguments have expired, the Administrator determines that the applicant for cancellation has established that the design is not subject to protection under the provisions of this chapter, he shall order the registration stricken from the record. Cancellation under this subsection shall be announced by publication, and notice of the Administrator's final determination with respect to any application for cancellation shall be sent to the applicant and to the proprietor of record.

"(d) When a design has been registered under this section, the lack of utility of any article in which it has been embodied shall be no defense to an infringement action under section 920, and no ground for cancellation under subsection (c) of this section or under section 923.

"CERTIFICATION OF REGISTRATION

"SEC. 913. Certificates of registration shall be issued in the name of the United States under the seal of the Office of the Administrator and shall be recorded in the official records of that office. The certificate shall state the name of the useful article, the date of filing of the application, the date of registration, the date the design was made public, if earlier than the date of filing of the application, and shall contain a reproduction of the drawing or other pictorial representation showing the design. Where a description of the salient features of the design appears in the application, this description shall also appear in the certificate. A certificate of registration shall be admitted in any court as prima facie evidence of the facts stated therein.

"PUBLICATION OF ANNOUNCEMENTS AND INDEXES

"SEC. 914. (a) The Administrator shall publish lists and indexes of registered designs and cancellations thereof and may also publish the drawing or other pictorial representations of registered designs for sale or other distribution.

"(b) The Administrator shall establish and maintain a file of the drawings or other pictorial representations of registered designs, which file shall be available for use by the public under such conditions as the Administrator may prescribe.

"FEES

"SEC. 915. (a) There shall be paid to the Administrator the following fees:

"(1) On filing each application for registration or for renewal of registration of a design, $15.

"(2) For each additional related article included in one application, $15.

"(3) For recording an assignment, $3 for the first six pages, and for each additional two pages or less, $1.

"(4) For a certificate of correction of an error not the fault of the Office, $10.

"(5) For a certification of copies of records, $1.

"(6) On filing each application for cancellation of a registration, $15.

"(b) The Administrator may establish charges for materials or services furnished by the Office, not specified above, reasonably related to the cost thereof.

"REGULATIONS

"SEC. 916. The Administrator may establish regulations not inconsistent with law for the administration of this chapter.

"COPIES OF RECORDS

"SEC. 917. Upon payment of the prescribed fee, any person may obtain a certified copy of any official record of the Office of the Administrator, which copy shall be admissible in evidence with the same effect as the original.

"CORRECTION OF ERRORS IN CERTIFICATES

"SEC. 918. The Administrator may correct any error in a registration incurred through the fault of the Office, or, upon payment of the required fee, any error of a clerical or typographical nature not the fault of the Office occurring in good faith, by a certificate of correction under seal. Such registration, together with the certificate, shall thereafter have the same effect as if the same had been originally issued in such corrected form.

"OWNERSHIP AND TRANSFER

"SEC. 919. (a) The property right in a design subject to protection under this chapter shall vest in the author, the legal representatives of a deceased author or of one under legal incapacity, the employer for whom the author created the design in the case of a design made within the regular scope of the author's employment, or a person to whom the rights of the author or of such employer have been transferred. The person or persons in whom the property right is vested shall be considered the proprietor of the design.

"(b) The property right in a registered design, or a design for which an application for registration has been or may be filed, may be assigned, granted, conveyed, or mortgaged by an instrument in writing, signed by the proprietor, or may be bequeathed by will.

"(c). An acknowledgment as provided in section 911 shall be prima facie evidence of the execution of an assignment, grant, conveyance, or mortgage.

"(d) An assignment, grant, conveyance, or mortgage shall be void as against any subsequent purchaser or mortgagee for a valuable consideration, without notice, unless it is recorded in the Office of the Administrator within three months from its date of execution or prior to the date of such subsequent purchase or mortgage.

"REMEDY FOR INFRINGEMENT

"SEC. 920. (a) The proprietor of a design shall have remedy for infringement by civil action instituted after issuance of a certificate of registration of the design.

"(b) The proprietor of a design may have judicial review of a final refusal of the Administrator to register the design, by a civil action brought as for infringement and shall have remedy for infringement by the same action if the court adjudges the design subject to protection under this chapter: *Provided,* That (1) he has previously duly filed and duly prosecuted to such final refusal an application in proper form for registration of the design, and (2) he causes a copy of the complaint in action to be delivered to the Administrator within ten days after the commencement of the action, and (3) the defendant has committed acts in respect to the design which would constitute infringement with respect to a design protected under this chapter.

"(c) The Administrator may, at his or her option, become a party to the action with respect to the issue of registrability of the design claim by entering an appearance within sixty days after such service, but the Administrator's failure to become a party shall not deprive the court of jurisdiction to determine that issue.

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"INJUNCTION

"SEC. 921. The several courts having jurisdiction of actions under this chapter may grant injunctions in accordance with the principles of equity to prevent infringement, including, in their discretion, prompt relief by temporary restraining orders and preliminary injunctions.

"RECOVERY FOR INFRINGEMENT, AND SO FORTH

"SEC. 922. (a) Upon finding for the claimant, the court shall award such claimant damages adequate to compensate for the infringement, but in no event less than the reasonable value the court shall assess them. In addition, the court may increase the damages to such amount, not exceeding $50,000 or $1 per copy, whichever is greater, as to the court shall appear to be just. The damages awarded in any of the above circumstances shall constitute compensation and not a penalty. The court may receive expert testimony as an aid to the determination of damages.

"(b) Alternatively, the court may award the claimant the infringer's profits resulting from the sale of the copies if it finds that the infringer's sales are reasonably related to the use of the claimant's design. In such a case, the claimant shall be required to prove only the infringer's sales and the infringer shall be required to prove its expenses against such sales.

"(c) No recovery under paragraph (a) shall be had for any infringement committed more than three years prior to the filing of the complaint.

"(d) The court may award reasonable attorney's fees to the prevailing party. The court may also award other expenses of suit to a defendant prevailing in an action brought under section 920(b).

"(e) The court may order that all infringing articles, and any plates, molds, patterns, models, or other means specifically adapted for making the same be delivered up for destruction or other disposition as the court may direct.

"POWER OF COURT OVER REGISTRATION

"SEC. 923. In any action involving a design for which protection is sought under this chapter, the court when appropriate may order registration of a design or the cancellation of a registration. Any such order shall be certified by the court to the Administrator, who shall make an appropriate entry upon the record.

"LIABILITY FOR ACTION ON REGISTRATION FRAUDULENTLY OBTAINED

"SEC. 924. Any person who shall bring an action for infringement knowing that registration of the design was obtained by a false or fraudulent representation materially affecting the rights under this chapter, shall be liable in the sum of $1,000, or such part thereof as the court may determine, as compensation to the defendent, to be charged against the plaintiff and paid to the defendant, in addition to such costs and attorney's fees of the defendant as may be assessed by the court.

"PENALTY FOR FALSE MARKING

"SEC. 925. (a) Whoever, for the purpose of deceiving the public, marks upon, or applies to, or uses in advertising in connection with any article made, used, distributed, or sold, the design of which is not protected under this chapter, a design notice as specified in section 906 or any other words or symbols importing that the design is protected under this chapter, knowing that the design is not so protected, shall be fined not more than $500 for every such offense.

"(b) Any person may sue for the penalty, in which event, one-half shall go to the person suing and the other to the use of the United States.

"PENALTY FOR FALSE REPRESENTATION

"SEC. 926. Whoever knowingly makes a false representation materially affecting the rights obtainable under this chapter for the purpose of obtaining registration of a design under this chapter shall be fined not less than $500 and not more than $1,000, and any rights or privileges he may have in the design under this chapter shall be forfeited.

"RELATION TO COPYRIGHT LAW

"SEC. 927. (a) Nothing in this chapter shall affect any right or remedy now or hereafter held by any person under chapters 1 through 8 of this title, subject to the provisions of section 113 of this title.

"(b) When a pictorial, graphic, or sculptural work in which copyright subsists under chapters 1 through 8 of this title is utilized in an original ornamental design of a useful article, by the copyright proprietor or under an express license from such proprietor, the design shall be eligible for protection under the provisions of this chapter.

"RELATION TO PATENT LAW

"SEC. 928. (a) Nothing in this chapter shall affect any right or remedy available to or held by any person under title 35 of the United States Code.

"(b) The issuance of a design patent for an ornamental design for an article of manufacture under said title 35 shall terminate any protection of the design under this chapter.

"COMMON LAW AND OTHER RIGHTS UNAFFECTED

"SEC. 929. Nothing in this chapter shall annul or limit (1) common law or other rights or remedies, if any, available to or held by any person with respect to a design which has not been registered under this chapter, or (2) any trademark rights or right to be protected against unfair competition.

"ADMINISTRATOR

"SEC. 930. The Administrator and Office of the Administrator referred to in this chapter shall be the Register of Copyrights and Library of Congress, respectively.

"SEVERABILITY CLAUSE

"SEC. 931. If any provisions of this chapter or the application of such provision to any person or circumstance is held invalid, the remainder of the chapter or the application to other persons or circumstances shall not be affected thereby.

"AMENDMENT OF OTHER STATUTES

"SEC. 932. Title 28 of the United States Code is amended—

"(a) by inserting 'designs,' after 'patents,' in the first sentence of section 1338(a);

"(b) by inserting ', design,' after 'patent' in the second sentence of section 1338(a);

"(c) by inserting 'design,' after 'copyright,' in section 1338(b);

"(d) by inserting 'and registered designs' after 'copyrights' in section 1400; and

"(e) by revising section 1498(a) to read as follows:

"'(a) Whenever a registered design or invention described in and covered by a patent of the United States is used or manufactured by or for the United States without license of the owner thereof or lawful right to use or manufacture the same, the owner's remedy shall be by action against the United States in the Court of Claims for the recovery of his reasonable and entire compensation for such use and manufacture.

"'For the purposes of this section, the use or manufacture of a registered design or an invention described in and covered by a patent of the United States by a contractor, a subcontrator, or any person, firm, or corporation for the Government and with the authorization or consent of the Government, shall be construed as use or manufacture for the United States.

"'The court shall not award compensation under this section if the claim is based on the use or manufacture by or for the United States of any article owned, leased, used by, or in the possession of the United States, prior to, in the case of an invention, July 1, 1918, and in the case of a registered design, July 1, 1983.

"'A Government employee shall have the right to bring suit against the Government under this section except where he was in a position to order, influence, or induce use of the registered design or invention by the Government. This section shall not confer a right of action on any design registrant or patentee or any assignee of such design registrant or patentee with respect to any design created by or invention discovered or invented by a person while in the employment or service of the United States, where the design or invention was related to the official functions of the employee, in cases in which such functions included research and development, or in the making of which Government time, materials, or facilities were used.'.

"TIME OF TAKING EFFECT

"SEC. 933. This chapter shall take effect one year after enactment of this Act.

"NO RETROACTIVE EFFECT

"SEC. 934. Protection under this chapter shall not be available for any design that has been made public as provided in section 909(b) prior to the effective date of this chapter.

"SHORT TITLE

"SEC. 935. This chapter may be cited as the 'Design Protection Act of 1983'.".

SEC. 2. Title 17, United States Code, section 113, is amended by adding at the end thereof the following new subparagraphs:

"(d) When a pictorial, graphic, or sculptural work in which copyright subsists under chapters 1 through 8 of this title is utilized in an original ornamental design of a useful article, by the copyright proprietor or under an express license from him, the design shall be eligible for protection under the provisions of chapter 9 of this title.

"(e) Protection under chapters 1 through 8 of this title of a work in which copyright subsists shall terminate with respect to its utilization in useful articles whenever the copyright proprietor has obtained registration of an ornamental design of a useful article embodying said work under the provisions of chapter 9 of this title. Unless and until the copyright proprietor has obtained such registration, the copyright pictorial, graphic, or sculptural work shall continue in all respects to be covered by and subject to the protection afforded by the copyright subsisting under chapters 1 through 8 of this title.

"(f) Nothing in this section shall affect any right or remedy held by any person under chapters 1 through 8 of this title in a work in which copyright was subsisting on the effective date of chapter 9 of this title, or with respect to any utilization of a copyrighted work other than in the design of a useful article.".

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98TH CONGRESS
1ST SESSION

H. R. 1028

To amend title 17 of the United States Code to protect semiconductor chips and masks against unauthorized duplication, and for other purposes.

IN THE HOUSE OF REPRESENTATIVES

JANUARY 27, 1983

Mr. EDWARDS of California (for himself and Mr. MINETA) introduced the following bill; which was referred to the Committee on the Judiciary

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A BILL

To amend title 17 of the United States Code to protect semiconductor chips and masks against unauthorized duplication, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Semiconductor Chip Protection Act of 1983".

DEFINITIONS

SEC. 2. Section 101 of title 17 of the United States Code is amended by adding at the end thereof the following:

"A 'semiconductor chip product' is the final or intermediate form of a product—

"(1) having two or more layers of metallic, insulating, or semiconductor material, deposited on or etched away from a piece of semiconductor material in accordance with a predetermined pattern;

"(2) intended to perform electronic circuitry functions; and

"(3) that is a writing or a discovery, or the manufacture, use, or distribution of which is in or affects commerce.

"A 'mask work' is a series of related images—

"(1) having the predetermined, three-dimensional pattern of metallic, insulating, or semiconductor material present or removed from the layers of a semiconductor chip product; and

"(2) in which series the relation of the images to one another is that each image has the pattern of the surface of one form of the semiconductor chip product.

"A 'mask' is a substantially two-dimensional partially transparent and partially opaque sheet. A mask embodies a mask work if the pattern of transparent and opaque portions of the mask is substantially similar to the pattern of one of the images of the mask work.

Masks and mask works shall not be deemed pictorial, graphic, or sculptural works.

"As used in sections 109(a), 401, 405, 406, 501(a), 503, 506, 509, and 602 of this title, 'copy' includes a semiconductor chip product that is subject to the exclusive rights described in section 106.".

SUBJECT MATTER OF COPYRIGHT

SEC. 3. Section 102(a) of title 17 of the United States Code is amended—

(1) by adding after paragraph (5) the following:

"(6) mask works;"; and

(2) by redesignating paragraphs (6) and (7) as paragraphs (7) and (8), respectively.

EXCLUSIVE RIGHTS

SEC. 4. Section 106 of title 17 of the United States Code is amended—

(1) by striking out "and" at the end of paragraph (4);

(2) by striking out the period at the end of paragraph (5) and inserting "; and" in lieu thereof; and

(3) adding at the end thereof the following:

"(6) in the case of mask works—

"(A) to embody the mask work in a mask;

"(B) to distribute a mask embodying the mask work;

"(C) to use a mask embodying the mask work to make a semiconductor chip product;

"(D) in the manufacture of a semiconductor chip product, substantially to reproduce, by optical, electronic, or other means, images of the mask work on material intended to be part of the semiconductor chip product; and

"(E) to distribute or use a semiconductor chip product made as described in subclause (C) or (D) of clause (6) of this section.".

LIMITATION ON EXCLUSIVE RIGHTS AS TO MASKS

SEC. 5. (a) Chapter 1 of title 17 of the United States Code is amended by adding at the end the following:

"§ 119. Scope of exclusive rights: Compulsory licensing with respect to mask works

"(a) In the case of mask works, the exclusive rights provided by section 106 are subject to compulsory licensing under the conditions specified by this section.

"(b) The owner of a copyright on a mask work shall be required to grant a compulsory license under the copyright, to any applicant therefor, on the following terms and conditions, and in the following circumstances:

"(1) The applicant has purchased a semiconductor chip product made or distributed in violation of the owner's exclusive rights under section 106.

"(2) When the applicant first purchased such semiconductor chip product (hereinafter in this section referred to as the 'infringing product'), the applicant did not have actual knowledge that or reasonable grounds to believe that the infringing product was an infringing product (hereinafter in this section referred to as 'having notice of infringement').

"(3) The applicant, before having notice of infringement, committed substantial funds to the use of the infringing product; the applicant would suffer substantial out-of-pocket losses (other than the difference in price between the infringing product and a noninfringing product) if denied the use of the infringing product; and it would be inequitable in the circumstances not to permit the applicant to continue the use or proposed use of the infringing product.

"(4) The applicant offers, subject to the applicant's rights, if any, under section 501(e) of this title, to pay the copyright owner a reasonable royalty for infringing products.

"(5) The royalty shall be for each unit of the infringing product distributed or used by the applicant after having notice of infringement.

"(6) The license shall be one to make, have made (but only if the copyright owner and the owner's licensees, if any, are unable to supply the applicant at a reasonable price), use, and distribute the infringing product, for substantially the same purposes that gave rise to the applicant's right to a compulsory license, throughout the United States, for the life of the copyright, revocable only for failure to make timely payments of royalties.".

(b) The sectional analysis at the beginning of chapter 1 of title 17 is amended by adding the following:

"119. Scope of exclusive rights: Compulsory licensing with respect to mask works.".

DURATION OF COPYRIGHT

SEC. 6. Section 302 of title 17 of the United States Code is hereby amended by adding at the end thereof the following:

"(f) MASKS.—Copyright in mask works endures for a term of ten years from the first authorized—

"(1) distribution;

"(2) use in a commercial product; or

"(3) manufacture in commercial quantities

of semiconductor chip products made as described in subclause (C) or (D) of clause 6 of section 106 of this title.".

INNOCENT INFRINGEMENT

SEC. 7. Section 501 of title 17 of the United States Code is amended by adding at the end thereof the following:

"(e) Notwithstanding the other provisions of this chapter, a purchaser of a semiconductor chip product who purchased it in good faith, without having notice of infringement (as that term is used in section 119 of this title), shall not be liable as an infringer or otherwise be liable or subject to remedies under this chapter with respect to the use or distribution of units of such semiconductor chip product that occurred before such purchaser had notice of infringement.".

IMPOUNDING AND SEIZURE

SEC. 8. Sections 503(a), 503(b), and 509(a) of title 17 of the United States Code are each amended by inserting "masks," after "film negatives," each place it appears.

EFFECTIVE DATE

SEC. 9. The amendments made by this Act shall take effect ninety days after the date of enactment of this Act, but shall not apply to—

(1) semiconductor chip products manufactured in the United States or imported into the United States before the effective date;

(2) masks made in the United States or imported into the United States before the effective date; or

(3) semiconductor chip products manufactured in the United States by means of masks described in paragraph (2) of this section.

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