COPYRIGHT PROTECTION FOR IMPRINTED DESIGN PATTERNS ON SEMICONDUCTOR CHIPS

HEARING

BEFORE THE

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

OF THE

COMMITTEE ON THE JUDICIARY HOUSE OF REPRESENTATIVES

NINETY-SIXTH CONGRESS

FIRST SESSION

ON

H.R. 1007

COPYRIGHT PROTECTION FOR IMPRINTED DESIGN PATTERNS ON SEMICONDUCTOR CHIPS

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COPYRIGHT PROTECTION FOR IMPRINTED DESIGN PATTERNS ON SEMICONDUCTOR CHIPS

MONDAY, APRIL 16, 1979

HOUSE OF REPRESENTATIVES, SUBCOMMITTEE ON COURTS, CIVIL LIBERTIES AND THE ADMINISTRATION OF JUSTICE OF THE COMMITTEE ON THE JUDICIARY,

San Jose, Calif.

The subcommittee met, pursuant to notice, at 2 p.m., in Judge Kelly's courtroom, Santa Clara County Superior Court, 161 N. First Street, San Jose, Calif., the Honorable Robert Kastenmeier (chairman of the subcommittee) presiding.

Present. Representatives Kastenmeier, Edwards and Mineta.

Also present. Bruce A. Lehman, counsel; Thomas E. Mooney, associate counsel; and Audrey Marcus, clerk.

Mr. KASTENMEIER. The subcommittee will come to order.

We are gathered here today for the first hearing on the subject of extension of the Copyright Act for the protection of certain printed design patterns on the semiconductor chips.

In this connection I have a brief statement I would like to make, but first of all, before I say any more, I would like to yield to my colleague on the Judiciary Committee, who is part of this panel today, and indeed our host in this area, and my dear friend, and a person who himself has the principal bill on the subject before Congress, the Honorable Don Edwards.

Mr. EDWARDS. Thank you very much, Mr. Chairman.

I'm simply delighted this subcommittee has chosen to come to Santa Clara Valley, especially to San Jose, for this important hearing, which I believe very well might be the first official congressional hearing in the history of the city of San Jose. I can't remember an other; if there is anybody here who will say I am wrong, let him now speak. But, it's really very exciting to have this matter here representing the House Judiciary Committee, and it's especially good for me to have my friend and colleague, Congressman Bob Kastenmeier, chairing this particular hearing. He is chairman of the House Judiciary Subcommittee on Courts, Civil Liberties and the Administration of Justice. Bob has been a member of the House of Representatives from Wisconsin for 20 years, and he is the acknowledged expert in Congress on the very sophisticated and complicated matter of copyrights.

The copyright laws, until 1976, had not been revised in a major way since 1909, and Congressman Kastenmeier as a member of the Presidential Commission and as the chairman of this subcommittee, and I as a member of the subcommittee for a number of years, were privileged to be a part of the process. Congressman Kastenmeier's subcommittee completely revised the copyright laws of the

United States, and I might say satisfying or at least compromising the varied claims of book publishers, authors, record people, TV companies, and of course the general public. This resulted in the very important revision of the Copyright Act that was passed just a couple of years ago by both the House and the Senate.

This subject of the bill today, Mr. Chairman, the copying of industrial designs, is something new; it's new to me, it's new to the subcommittee, and indeed it's a new concept that apparently is new to the law of copyrights.

I also, as someone representing this area for 17 years, want to welcome to San Jose and Santa Clara County distinguished members of your staff, lawyers Bruce Lehman, Tom Mooney, and Audrey Marcus, who is also very welcome.

I am pleased to be here, I thank you for allowing me to participate in these hearings. My colleague, who also represents San Jose, Norm Mineta, I'm sure will be here shortly, and thank you again for having these hearings in San Jose.

Mr. KASTENMEIER. Thank you, Congressman Edwards. We appreciate that introduction and hospitality. We do hope that both Congressman Mineta and Congressman McCloskey, who expressed an interest in this issue will be present at some point during these hearings. I would have wished that a larger component of our panel could have been here today, but unfortunately a number of other conflicting activities are taking place involving Congress, so the panel that we have before us is the one that will be conducting these hearings. Mr. Mooney will be representing the minority, and Mr. Lehman is the general counsel. They are invited to ask questions as well as Mr. Edwards and if the other members appear they too may ask questions of our witnesses today.

Patent trademark and copyright laws arise out of the need to define rights in intangible creations which arise purely out of human intellect.

These rights cannot be protected from theft or trespass by simple physical possession by the owner. The drafters of our Constitution recognized this by specifically granting to Congress 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.

Two centuries ago, this responsibility consisted of defining the rights of creators of simple mechanical devices, books, charts, and maps.

Over the years science and the useful arts have, indeed, progressed to the point where we are called upon to consider defining rights in everything from new biological life forms to computer software. The legislation before us today, H.R. 1007, again requires us to wrestle with defining the rights of creators in the space age.

H.R. 1007 would protect designs in computer semiconductor chips by including them under the copyright law.

[A copy of H.R. 1007 follows:]

96TH CONGRESS
1ST SESSION

H. R. 1007

To amend the Copyright Act of 1976 to provide copyright protection for imprinted design patterns on semiconductor chips.

IN THE HOUSE OF REPRESENTATIVES

JANUARY 18, 1979

Mr. EDWARDS of California (for himself, Mr. MCCLOSKEY, and Mr. MINETA) introduced the following bill; which was referred to the Committee on the Judiciary

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A BILL

To amend the Copyright Act of 1976 to provide copyright protection for imprinted design patterns on semiconductor chips.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, 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.".

The Santa Clara Valley is the center of the Nation's semiconductor industry. Therefore, it is appropriate that we hold our hearings on this legislation here in San Jose. This is the first time, indeed, I have been privileged to visit this remarkable community which is both a part of the Old California and part of the very, very new and modern California.

I would like to also say that the committee, the other members of the committee, and myself are not experts on this particular subject, but I suspect that we would feel optimistic about the possibility of resolving, if that's what is required, whatever problems exist here. To a very great extent the committee has been successful in the past in accommodating various interests in terms of copyright law, copyright protection as modified by acts of Congress.

I have today, in addition to the witness list we originally presented to you, included two other witnesses who will have a somewhat different position to communicate to us, and reorder the list by calling upon John Baumgarten to be the first witness today to start it off. We will then call upon Mr. Grove, Mr. Borovoy, Mr. Sevin, and finally Dr. Angell and two other witnesses which we will introduce at that time.

In the process of copyright, Mr. Baumgarten, together with the Register, Barbara Ringer, have played a very important role over the past years while we were considering this. It is a pleasure for me to greet, really, a Washingtonian up here in San Jose. We've elected to come to this site because so much of what we presume to effect by virtue of examining the bill before us is in fact manufactured, made here, and it affects the community as well as the nation in terms of the potential of any variation of law on the subject.

Mr. Baumgarten is general counsel of the Copyright Office in the Library of Congress. We are very pleased to greet a person who has been a great help to this committee and an expert witness for us on many, many other occasions.

Mr. Baumgarten.

TESTIMONY OF JON BAUMGARTEN, GENERAL COUNSEL, U.S. COPYRIGHT OFFICE, LIBRARY OF CONGRESS

Mr. BAUMGARTEN. Thank you, Mr. Chairman.

Mr. Chairman, Mr. Edwards, I have a prepared statement I would like to submit for the record. I will follow it rather closely, but I will not read it in its entirety.

Mr. KASTENMEIER. Without objection your statement will be admitted into the record.

Incidentally, at the outset, perhaps I will address myself to the staff, if there is no objection as far as the media is concerned, any coverage, photography or otherwise, of these events will be made in order.

Mr. Baumgarten, you may proceed.

Mr. BAUMGARTEN. Mr. Chairman, Mr. Edwards, my name is Jon Baumgarten, and I am General Counsel of the U.S. Copyright Office. I appear here today in support of the principle of protection "for imprinted design patterns on semiconductor chips" reflected in H.R. 1007; at the same time, I plan to suggest several issues we

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believe the subcommittee should consider before approving that bill in its present form.

In summary, and on the basis of our own limited knowledge of the relevant technology and subject matter, we believe first that the layout design of semiconductor chips does in fact embody original, creative intellectual effort; second, that the "photographic masks" and "imprinted design patterns" referred to in H.R. 1007, are tangible representations of the designer's effort; and third, that the expression of that effort in a particular drawing, layout, mask, and chip design is not strictly determined by the function to be performed by the chip, and represents a choice from among varying alternatives.

Accordingly, we feel that Congress may well conclude that the "photographic masks" and "imprinted patterns" covered by H.R. 1007 are "writings of an author" in the constitutional sense, and "original works of authorship" that it may choose to protect under the Copyright Act. However, our expertise in the area of integrated circuit chips and related devices is quite limited, and we have a number of questions we urge the subcommittee to consider before it approves either the principle of copyright protection or the terms of H.R. 1007 itself.

Before proceeding to these questions, Mr. Chairman, it might be helpful to outline our current registration practices with respect to semiconductor "chips" and related materials, the bases for these practices, and our understanding of the industry's reaction to them. Before doing so, I would remind the subcommittee that the Copyright Office does not "grant" or "deny" copyrights. Under the act of 1976, if a work is copyrightable subject matter, it is "automatically" copyrighted as soon as it is "created." Although registration in the office has a number of advantages it is not a condition of copyright. If the Copyright Office refuses to register a work, a court may still conclude that it was in fact copyrights; conversely, our registration of a work, although having certain evidentiary effect, does not preclude a judicial determination that it is not protected.

Turning to our practices:

First, with respect to schematic diagrams, "mylar sheets", photolithographic "masks" and similar representations, the Copyright Office will generally now register claims to copyright in these works. We consider them to be in the nature of scientific or technical drawings—an architectural blueprint might be another example—which convey or depict information. I would note that within the office as one proceeds in stages from the original hand-drawn paper-type layout to the mask itself, we have occasionally raised questions in correspondence due to uncertainty on our part as to whether the masks and like devices do in fact convey information or are merely a mechanical adjunct of the manufacturing process. Notwithstanding these questions, our general rule is that we will make registration for the diagram or mask.

It is our understanding that the proponents of chip protection are hesitant to rely solely on registration of the diagrams, sheets, and masks for at least three reasons:

First, the final chip configuration represents an integration of a number of individual "drawings", and the final product may be different from each of the individual layouts in itself.

Second, the diagrams, sheets and masks which we will register are not exposed on the market. When unauthorized duplication occurs it is usually done from the finished chip and not from the layout, drawing, or mask.

Finally, the extent to which copyright in the diagram sheet or mask protects against duplication from the chip is uncertain under 113(b) of the Copyright Act.

Mr. Chairman, I don't think it's necessary to read the section. As far as legislative history, that appears on pages 3 and 4 of this statement.

Turning from the layout, masks and schematics to the actual configuration of the chips, or in the words of H.R. 1007, "the imprinted patterns * * * on integrated circuit chips"—the Copyright Office will generally refuse registration. This practice—which apparently goes back to a much earlier generation of printed circuits—is based on essentially two related facts.

The first basis for our rejection is the definition of "pictorial, graphic, or sculptural works", which appears in section 101 of the new Copyright Act, and that section itself is a codification of an earlier regulation of the Copyright Office. That regulation in turn was a codification of the practices of the Office going back to 1909.

Again, Mr. Chairman, the text of the section and your committee's own legislative explanation of its operation is set forth on page 5 and 6 of the prepared statement and I don't think it necessary to read them to you. Perhaps it might be best paraphrased by referring to your committee's report where we said the copyright under the bill will not extend to the design of a refrigerator or an automobile or an airplane, and that if we add the words "computer" or "minicomputer" to that, that in a simplistic way is the basis upon which we refuse registration of the configuration of the chip.

The second factor related to the definition in the statute is case law. There have been a number of decisions which are cited in page 6 of the statement which raise a number of significant legal and policy questions about the copyrightability of elements of mechanical and scientific devices. These cases raised questions, and in fact the two cases cited refused protection to works which were essentially parts of the calculating device. The court was concerned that by extending copyright protection to that part it might be extending the patent monopoly given to the device as a whole.

Third, with respect to computer programs "stored" in the chips, the Copyright Office will generally register claims to copyright in these works. Under our deposit regulations, a visually perceptible printout of the program, rather than the chip itself, must accompany the application.

Again, Mr. Chairman, the merger of hardware and software within the chip has raised questions within the office about whether the program stored in the chip is a program as we traditionally consider it; however, again, as with the drawings, we generally make registration.

It is our understanding the proponents of protection for chip patterns also usually support copyright protection of computer pro-

grams; however, they apparently believe that copyright in programs does not offer adequate protection against duplication of the chips. The reasons for this are not always clearly expressed, or at least I have not seen them clearly expressed, but we would imagine they are one or more of the following:

First, the chips for which they seek protection include types that do not embody computer programs at the time they are exposed to duplication. For example, there are "blank" chips or unprogramed chips which are sold for programing by the customer and might be copied before the program is loaded onto the chip, or there are in fact chips which are not designed to hold programed material at all.

Second, unauthorized duplicators of even "programed" chips may, we understand, avoid duplication of that part of the chip which carries the program; and finally, the copyright owner in the program may not be the same as the claimant of rights in the chip pattern design.

For these reasons, Mr. Chairman, it's our understanding that the proponents of protection in H.R. 1007 would not be comfortable merely resting upon copyright protection for the computer program.

In adopting the practices I have described, most notably our exclusion of chip configurations, the Copyright Office believes it is following the language and spirit of the Copyright Act, and particularly the dividing line between artistic works and "industrial designs," which your committee referred to in it's 1976 report. As I have indicated, we do not mean to detract from the efforts of chip designers. We believe that these efforts represent substantial originality, ingenuity, creativity, and investment, and in fact deserve protection against the increased and improved techniques of unauthorized duplication which have led to the introduction of H.R. 1007. We do, however, have a number of questions pertaining to the accuracy of our assumptions and the nature and scope of protection. These questions may be divided into five areas. Specifically, we respectfully suggest:

1. That the subcommittee 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 "masks" and "patterns" is not dictated by the function to be performed by the chip and does represent the creative choice from among different possibilities. This standard is implicit in our assumption that the words to be protected are the results of "authorship." If this assumption is not the case, there would be a very clear danger that the protection could go beyond the purpose of copyright in protecting not only the "expression" of the designer's concept, but the concept itself, and the principle of operation. Concepts, principles, and the like, have never been considered to be a part of the copyright protection, and are not intended to be.

2. The subcommittee should explore the relationships among, first, schematic drawings, mylar sheets, photographic masks and related devices; second the "patterns" imprinted on the chips; third, computer programs, if any, stored in the chips; and finally, computer programs used in generating the finished chip or its intermediate stages. The subcommittee should consider whether

protection already to each of these elements under existing mechanical, process, design patent, or copyright law, offers sufficient protection against chip duplication. If they do not, you might consider whether any policy considerations which underlie this absence.

3. Perhaps most importantly, the subcommittee should consider whether, in light of the existing and anticipated industry structure and technology, copyright protection of the "masks" and "imprinted patterns" should be subject to specific limitations regarding the term of protection, the scope of rights, or the nature of remedies against infringement. The precedents for this type of limitation, is a limitation adapted for specific purposes to particular works, include a number that this subcommittee is familiar with:

(a) The Sound Recordings Amendment of 1971, when Congress first extended copyright protection to sound recordings, it limited the right in sound recordings to protection against "dubbing" and direct electronic duplication, and expressly excluded protection against imitation—so-called "sound-alike" records. Similarly, Congress did not accord a performance right in the sound recording to recording artists or record producers. These limitations demonstrated Congress intent to provide effective protection and remedies for the industrial problem of record piracy, without altering other legal relationships under copyright between music copyright owners, record producers and broadcasters. The new Copyright Act, as the chairman is aware, continued these limitations on the reproduction of performance rights which are usually accorded by copyright.

(b) The Report of the National Commission on New Technological Uses of Copyrighted Works. The 1978 report did recommend that the copyright law be amended to make it clear that copyright protection extends to computer programs. At the same time, the report suggested that the usual reproduction and adaptation rights of copyright owners be somewhat limited in order to assure that the rightful possessors of copies of programs use or adopt them for their use.

(c) Perhaps most clearly to the point, design legislation. For many years, bills have been introduced in Congress to provide copyright protection for industrial designs, or in the words of the bills, "original ornamental designs of useful articles." H.R. 2706, recently introduced by Mr. Railsback on March 7, is the most recent of these proposals. As this subcommittee will recall, a similar proposal appeared as title II of the copyright revision bill, but, at the urging of your committee, was reserved for additional congressional consideration. In a real sense, Mr. Chairman, the hearings being held today on H.R. 1007 may be considered to be the first step in the reconsideration of industrial design protection promised in your committee's report.

Each of the design bills would have accorded copyright protection for industrial designs. That is, protection based upon principle of originality rather than on the principle of novelty and invention embodied in the patent laws; however, in response to particular considerations of consumer preference, market structure and economic impact, the bills also included specific departures from ordinary copyright principles. These departures or limitations included

such devices as a shortened term of protection specifically related to the need for protection; the protection of innocent retailers from liability for infringement. The traditional copyright principle has been that seller of an infringing article is as liable as its maker. The design bills would remove the liability of the seller; and provisions for administrative cancellation procedures.

The subcommittee might consider whether limitations of this nature are appropriate in the area of chip designs. For example, copyright protection under the law that exists for 75 years from publication, or 100 years from creation of the chip, assuming they are works made for hire. The subcommittee may conclude that this is much too long protection for a device, although protection for some shortened period is indeed warranted.

Another precedent for specific limitations, Mr. Chairman, is the concept of typeface protection. The committee will recall that during the debates over copyright protection for typeface designs, it was suggested that because of the nature of the typographic industry and the possible reach of ordinary copyright remedies to those who produced or distributed books set in "infringing type," and potential first amendment implications, typeface protection should be subject to certain limits which included compulsory licensing of reproduction rights, and a limitation of remedies to those who directly duplicated fonts, and not extending to those who produced works distributed in infringing type. As with the case of design protection, your committee deferred the entire matter of typeface protection for more thorough consideration.

There are numerous other instances where Congress has concluded that the "usual" attributes of copyright protection, that is the absolute rights of reproduction, adaptation, performance and display, and the usual term of those rights, should be limited in application to particular works for particular uses. These are set forth in section 107 through 118 of the new law.

Significantly, and bringing the point home to chip design, some earlier discussions of chip piracy have suggested that certain forms of partial or reverse duplication should not be inhibited, in order to assure development of the art. There were specific suggestions to this effect in Mr. Edwards' statement in the Congressional Record of October 14, 1978.

Another area we suggest the subcommittee look into is the technical accuracy of certain terms employed in the proposed bill. We note that the title of the bill refers to "semiconductor chips," while its text identifies "integrated circuit chips," and with our limited knowledge we do understand that these different terms may have differing connotations, and we suggest that this be clarified.

The bill also refers to "imprinted patterns—incorporated in useful articles". We believe this suggests some clarification as to whether protection is to be limited to the surface appearance of the chip as implied in the use of the term "chip topography" in our prior experience with these words, or whether protection is to extend to the subsurface configuration of finished chips.

Finally, gentlemen, we believe the committee should consider expressly limiting the amendment, at least in terms of the "imprinted patterns", to those chips created after its effective date. This has been a common part of amendments in the past which

bring new subject matter or new rights, such as sound recordings, musical compositions, performance rights in dramas, and photographs, under the copyright law. In considering this question, the committee will, of course, want to explore the effect of such a limitation on the existing chips, but we believe you should also explore the expected useful life of the existing chips, the impact of retroactive protection upon uses of the chips, and indeed, earlier forms of printed circuits made before the effective date, and a general copyright policy against recapturing works from the public domain.

In concluding, I would point out that the issues I have discussed today involve the application of traditional principles of copyright law to works, and indeed to industries and markets, whose technology is still very new. But the sophistication and the newness of the subject matter should not conceal the familiarity of the basic issue: Whether existing law is adequate to offer protection against rapidly developing technologies of unauthorized reproduction, or whether it should be amended to do so.

Your committee has dealt with this specific type of issue twice in recent years, with differing results: In the early days of record piracy, although it has been a problem, it did not have the major impact on the industry it now has because to be a pirate you had to set up a record pressing plant with extensive record pressing equipment; however, with the development of consumer acceptance of tape, and the development of high speed tape duplicators, the need for protection became greater because it was easier to become a pirate; you bought a tape machine and set up operation in your garage. At that point the record industry pressed hard for copyright protection and your committee and the Congress responded affirmatively with the Sound Recordings Amendment of 1971. The opposite result was reached with respect to typeface. Again, in earlier days, typeface piracy was a problem, but assumed lesser proportions because the pirate of typeface had to go to considerable effort in reproducing the matrices; however, when typeface design became embodied in photographic form, to become a pirate all you needed was a camera, and you copied the photo. The rapid progress of the technology of duplication led the typeface interests to come to Congress for copyright protection. In this case, your committee responded by saying you wished to consider the matter further. We suggest this is the same type of issue, the type of issue faced in record piracy and the type of issue faced in typeface design, that your committee faces at this time.

Thank you for the opportunity to appear before you today, and on behalf of the Register and the Office, I'll be pleased to answer any questions you might have.

Mr. KASTENMEIER. Thank you, Mr. Baumgarten.

[The prepared statement of Mr. Baumgarten follows:]

STATEMENT OF JON BAUMGARTEN, GENERAL COUNSEL, U.S. COPYRIGHT OFFICE

Mr. Chairman and members of the subcommittee, my name is Jon Baumgarten and I am General Counsel of the United States Copyright Office. I appear here today in support of the principle of protection "for imprinted design patterns on semiconductor chips" reflected in H.R. 1007; at the same time, I plan to suggest several issues we believe the subcommittee should consider before approving that bill in its present form.

In summary, on the basis of our limited understanding of the relevant technology and subject matter, we believe: (1) that the layout design of semiconductor chips does in fact embody original, creative intellectual effort; (2) that the "photographic masks" and "imprinted design patterns" are tangible representations of the designer's effort; and (3) that the expression of that effort in a particular drawing, layout, mask, and chip design is not strictly determined by the function to be performed by the chip, and represents a choice from among varying alternatives.

Accordingly, we feel that Congress may well conclude that the "photographic masks" and "imprinted patterns" covered by H.R. 1007 are "writings of an author" in the Constitutional sense,[1] and "original works of authorship" that it may choose to protect under the Copyright Act.[2] However, our expertise in the area of integrated circuit chips and related devices is quite limited, and we have a number of questions we urge this subcommittee to consider before it approves either the principle of copyright protection embodied or the terms of H.R. 1007.

Before proceeding to these questions, it may be helpful to outline the Copyright Office's current registration practices with respect to semiconductor "chips" and related materials, the bases for these practices, and our understanding of the industry's reaction to them. Before doing so, I would remind the subcommittee that the Copyright Office does not "grant" or "deny" copyrights. Under the Act of 1976, if a work is copyrightable subject matter, it is "automatically" copyrighted as soon as it is "created". Although registration has a number of advantages it is not a condition of copyright. If the Copyright Office refuses to register a work, a court may still conclude that it was in fact copyrighted; conversely, our registration of a work—although having evidentiary effect—does not preclude a judicial determination that it is not protected.

Turning to our practices:

First, with respect to schematic diagrams, "mylar sheets", photolithographic "masks" and similar representations—the Copyright Office will generally now register claims to copyright in these works. We consider them to be in the nature of scientific or technical drawings which convey or depict information. (As one goes from the original "paper"-type layout to the masks, questions about registrability have been raised in the Copyright Office; these are due to uncertainty as to whether the masks and like devices do convey information, or merely form a mechanical adjunct to the manufacturing process. However, registration will usually be made.)

We understand that proponents of chip protection are hesitant to rely solely on registration of diagrams, sheets, and masks because: (a) the final chip configuration represents an integration of several individual "drawings"; (b) these diagrams, sheets, and masks are not exposed on the market—unauthorized duplication is usually done from the finished chip; and (c) the extent to which copyright in the diagram, sheet, or mask protects against duplication from the chip is uncertain under section 113(b) of the Copyright Act. That section provides:

> 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.

As explained in your committee's 1976 report:

> The broad language of section 106(1) and of subsection (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

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[1] "By Art. I, § 8, cl. 8, of the Constitution, the States granted to Congress the power to protect the 'Writings' of 'Authors.' These terms have not been construed in their narrow literal sense but, rather, with the reach necessary to reflect the broad scope of constitutional principles. . . . The term ['author'], in its constitutional sense, has been construed to mean an 'originator', 'he to whom anything owes its origin'. . . . Similarly, although the word 'writings' might be limited to script or printed material, it may be interpreted to include any physical rendering of the fruits of creative intellectual or aesthetic labor." *Goldstein* v. *California*, 412 U.S. 546, 561 (1973).

[2] Under section 102(a) the new Copyright Act, copyright subsists in fixed "original works of authorship." In discussing this standard, your committee's report noted: "Authors are continually finding new ways of expressing themselves, but it is impossible to foresee the forms that these new expressive methods will take. The bill does not intend either to freeze the scope of copyrightable technology or to allow unlimited expansion into areas completely outside the present congressional intent. Section 102 implies neither that that subject matter is unlimited nor that new forms of expression within that general area of subject matter would necessarily be unprotected. . . . Although the coverage of the present statute is very broad, and would be broadened further by the explicit recognition of all forms of choreography, there are unquestionably other areas of existing subject matter that this bill does not propose to protect but that future Congresses may want to." H.R. Rep. 94-1476, 94th Cong., 2d Sess. (1976) at 51-52.

in such a way that the utilitarian nature of the article can be seen. To take the example usually cited, would copyright in a drawing or model of an automobile give the artist the exclusive right to make automobiles of the same design?

The 1961 Report of the Register of Copyrights stated, on the basis of judicial precedent, that "copyright in a pictorial, graphic, or sculptural work, portraying a useful article as such, does not extend to the manufacture of the useful article itself," and recommended specially that "the distinctions drawn in this area by existing court decisions" not be altered by the statute. The Register's Supplementary Report, at page 48, cited a number of these decisions, and explained the insuperable difficulty of finding "any statutory formulation that would express the distinction satisfactorily." 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." [H.R. Rep. 94-1476 (94th Cong., 2d Sess.) at 105]

Second, with respect to the configuration of the chips themselves or, in the words of H.R. 1007, "the imprinted patterns . . . on integrated circuit chips"—the Copyright Office will generally refuse registration. This practice (which appears to extend back to the earlier generation of printed circuits) is based essentially on two related factors:

(a) The definition of "pictorial, graphic, or sculptural works" in section 101 of the new Copyright Act.[3] That section now reads:

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.*" ("Useful articles" are defined as those having an "intrinsic utilitarian function that is not merely to portray the appearance of the article or to convey information.)

Your committee's 1976 report explained the underscored language as follows:

In adopting this amendatory language [underscored above], the Committee is seeking to draw as clear a line as possible between copyrightable works of applied art and uncopyrighted works of industrial design. A two-dimensional painting, drawing, or graphic work is still capable of being identified as such when it is printed on or applied to utilitarian articles such as textile fabrics, wallpaper, containers, and the like. The same is true when a statute or carving is used to embellish an industrial product or, as in the *Mazer* case, is incorporated into a product without losing its ability to exist independently as a work of art. On the other hand, although the shape of an industrial product may be aesthetically satisfying and valuable, the Committee's intention is not to offer it copyright protection under the bill. 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. [H.R. Rep. 94-1476, 94th Cong. 2d Sess. at 55]

(b) Case law. Decisions such as *Taylor Instruments Companies* v. *Fawley-Brost Co.*, 139 F.2d. 98 (7 Cir. 1943), *cert. denied*, 321 U.S. 785 (1944) and *Brown Instrument Co.* v. *Warner*, 161 F.2d 910, *cert. denied*, 332 U.S. 801 (1947) raise significant legal (and policy) questions about the copyrightability of elements of mechanical or scientific devices. Both cited cases refused protection to certain calibrated charts used with temperature recording devices. In *Brown Instruments*, for example, the court said:

[3] The definition is essentially a codification of a Copyright Office regulation under the law in effect before January 1, 1978. See 37 C.F.R. 202.10(c) (1973). That regulation was adopted in 1964, but it represents Copyright Office practice going back to 1909. See *Stein* v. *Mazer*, 204 F.2d 472, 477 (4th Cir. 1953), *affirmed*, *Mazer* v. *Stein*, 347 U.S. 201 (1954).

> Both law and policy forbid monopolizing a machine except within the comparatively narrow limits of the patent system. In several patents on recording machines, the necessary printed chart is rightly claimed as one of the operative elements. Since the machines which cooperate with the charts in suit are useless without them, to copyright the charts would in effect continue appellant's monopoly of its machines beyond the time authorized by the patent law.

Third, with respect to computer programs "stored" in chips—the Copyright Office will generally register claims to copyright in these works. Under our deposit regulations, 37 C.F.R. 202.20(c)(2) (vii)(1978), a visually perceptible print-out of the program, rather than the chip, must accompany the application. [The merger of "software" and "hardware" in the chip has occasionally raised questions in the Office as to the nature of programs "stored" in these devices, but again registration is usually made.)

Proponents of protection for chip patterns also usually support copyright protection of computer programs; however, they apparently believe that copyright in programs does not offer adequate protection against duplication of computer chips. The reasons for this are not clearly expressed, but appear to be one or more of the following: (a) the chips for which they seek protection include types that do not embody computer programs at the time they are exposed to duplication (for example, "blank" chips sold for customer programming, or not designed to hold program material); (b) unauthorized duplicators of even "programmed" chips may avoid duplication of that part of the chip carrying the program; and (c) the copyright owner in the program may not be the same as the claimant of proprietary rights in the chip pattern design.

In adopting the practices I have described, most notably our exclusion of chip configurations, the Copyright Office believes it is following the language and spirit of the Copyright Act—and particularly the dividing line between artistic works and "industrial design" referred to in your Committee's report. We do not mean to detract from the efforts of chip designers. As I have indicated, we believe that these efforts represent substantial originality, ingenuity, creativity, and investment, and deserve protection against increased and improved techniques of unauthorized duplication. We do, however, have a number of questions pertaining to the accuracy of our assumptions, and the nature and scope of protection. These questions may be divided into five areas. Specifically, we respectfully suggest:

1. 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". If this is not the case, there would be a clear danger that the desired protection could go beyond the purpose of copyright in protecting "expression" rather than underlying "idea" and encroach upon the fundamental principle expressed in section 102(b) of the Copyright Act, namely, 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, or embodied in such work."

2. The subcommittee should explore the relationships among (a) schematic drawings, mylar sheets, photographic masks, (b) the "patterns" imprinted on the chips, (c) computer programs, if any, stored in the chips, and (d) computer programs used in generating the finished chip or its intermediate stages; and whether protection already available to each of these elements under existing mechanical, process, or design patent law, and copyright offers sufficient protection against chip duplication; or, if they do not, whether any policy considerations underlie this result.

3. The subcommittee should consider whether, in light of existing and anticipated industry structure and technology, copyright protection of the "masks" and "imprinted patterns" should be subject to specific limitations regarding the term of protection, the scope of exclusive rights, or the nature of remedies against infringement. The precedents for limitations adapted for specific purposes to particular works include:

(a) The Sound Recordings Amendment of 1971. When it first extended copyright protection to sound recordings, Congress limited the rights in such works to protection against direct electronic duplication ("dubbing"); it expressly excluded protection against imitation ("sound-alikes") and did not accord a performance right in the sound recording to recording artists or record producers. These limitations demonstrated Congress' intention to provide effective protection and remedies for the industrial problem of record piracy, without altering other legal relationships under copyright between music copyright owners, record producers and broadcast-

ers. The new Copyright Act, in section 114, continued these limitations on the reproduction and performance rights usually accorded by copyright.

(b) The Report of the National Commission on New Technological Uses of Copyrighted Works. The 1978 CONTU report recommended that the copyright law be amended "to make it explicit that computer programs, to the extent that they embody an author's original creation, are proper subject matter of copyright". The report accompanied this recommendation with the suggestion that the usual reproduction and adaptation rights of copyright owners be somewhat limited "to assure that rightful possessors of copies of computer programs can use or adapt these copies for their use."[4]

(c) Design legislation. For many years, bills have been introduced in Congress to provide copyright protection for "original ornamental designs of useful articles". H.R. 2706, introduced by Mr. Railsback on March 7, 1979, is the most recent of these proposals. As this subcommittee will recall, a similar proposal appeared as Title II of the Copyright Revision Bill, but, at the urging of your Committee, was reserved for additional Congressional consideration. Each of these design bills would have accorded "copyright"-type protection to industrial designs—that is, protection based upon original creative effort, rather than upon the principles of novelty and invention embodied in the patent laws. However, in response to particular considerations of consumer preference, market structure, and economic impact, the bills also included specific departures from ordinary copyright principles. These departures, or limitations, included a shortened term of protection specifically related to the need for protection; the protection of innocent retailers from liability for infringement; and provision for an administrative cancellation procedure.

(d) Typeface protection. The subcommittee will recall that, during the debates over copyright protection for typeface designs, it was suggested that because of the nature of the typographic industry, and the possible reach of ordinary copyright remedies to those who produced or distributed books or like works set in "infringing" type, typeface protection should be subject to certain limits. These included compulsory licensing of reproduction rights, and a limitation of remedies to those who directly duplicated protected fonts. As with the case of design protection, your Committee deferred the entire matter of typeface protection for more thorough consideration.

Other instances where Congress has concluded that the "usual" attributes of copyright protection should be limited in application to particular works or uses appear in sections 107–118 of the new Copyright Act. Significantly, some earlier discussions of "chip piracy" have suggested that certain forms of "partial" or "reverse" duplication should not be inhibited, in order to assure development of the art.

4. The subcommittee should consider the technical accuracy of certain terms employed in H.R. 1007. We note that the title of the bill refers to "semiconductor chips", while its text identifies "integrated circuit chips", and we understand that these different terms may have varying connotations. The bill's reference to "imprinted patterns . . . incorporated in a useful article" also suggests clarification as to whether protection is to be limited to the "surface appearance" of the chips (as implied in the use of the term "chip topography" in earlier discussions of this subject), or extends to the sub-surface configurations of finished chips.

5. Finally, we believe that the Committee should consider expressly limiting the amendment, at least in terms of the "imprinted patterns", to those chips created after its effective date. This has been a common part of amendments bringing new subject matter or rights (such as sound recordings, musical compositions, performance rights in dramas, and photographs) under the copyright law. In considering this question, the committee will want to explore not only its effect on existing chips, but also the expected "useful life" of these chips, the impact upon uses of chips (and earlier forms of printed circuitry) made before the effective date, and general copyright policy against "recapturing" works from the public domain.

The issues I have discussed today involve the application of traditional principles of copyright law to works—indeed to industries and markets—whose technology is still very new. But the sophistication and newness of the subject matter should not conceal the familiarity of the basic issue: whether existing law is adequate to offer

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[4] CONTU specifically recommended that the statute be amended to provide, in part: "it is not an infringement for the rightful possessor of a copy of a computer program to make or authorize the making of another copy or adaptation of that computer program *provided:* (1) that such a new copy or adaptation is created as an essential step in the utilization of the computer program in conjunction with a machine and that it is used in no other manner, or (2) that such new copy or adaptation is for archival purposes only and that all archival copies are destroyed in the event that continued possession of the computer program should cease to be rightful."

protection against rapidly developing technologies of unauthorized reproduction, or should be amended to do so.

Essentially, your Committee has dealt with this kind of issue twice in recent years, with differing results: affirmatively, when in the face of growing record and tape piracy, Congress enacted the Sound Recording Amendment of 1971, and, negatively, when Congress declined, in 1975, to amend the bill for general revision of the copyright law to protect original designs of typeface against photofont duplication. In both of these cases, the growth of reprographic technology—tape and high-speed duplicators on the one hand, and photoreproduction processes for typeface on the other—forced industries which long relied upon the technical difficulty of reproducing their works for practical protection to turn to copyright and Congress for relief.

Thank you for the opportunity to appear before you today; on behalf of the Copyright Office, we will be pleased to answer any questions you may have.

Mr. KASTENMEIER. We are pleased to greet Congressman Norm Mineta, cosponsor of the bill, along with Don Edwards and Pete McCloskey. We are very pleased to have Norm be able to stop by on this important question.

Before I entertain questions of Mr. Baumgarten, I'd be pleased to yield to Norm Mineta if he cares to make any further statements or opening statement.

Mr. MINETA. Thank you very much, Mr. Chairman. I apologize for being late. I had been notified it was a 2:30 hearing rather than 2 o'clock and I apologize for being late.

Mr. KASTENMEIER. Actually, you need not apologize. Originally they were scheduled for 2:30. We were not able to reach everybody to tell them that we were trying to reschedule them for 2 o'clock. We did that as we wanted to be able to accomplish today's activities before it got too late. So, you are not, in that sense, late at all.

Mr. MINETA. Mr. Chairman, I would like to submit for the record and ask that the text of my statement be included in the record.

Mr. KASTENMEIER. Without objection.

Mr. MINETA. I would like to thank you very, very much for taking the time to hold these very important hearings here in Santa Clara Valley, in what I think we consider to be the national home of the semiconductor industry; and to Congressman Edwards for taking the initiative in introducing this bill. I think it's important, not only for this area, but I think as far as this technology, it is new, and yet it's the kind of technology that has to be protected at the infant stage rather than to let something drag on too long and then try to come up with other kinds of remedial measures when the damage has already been done. So, I would hope, and I know that you will consider all the testimony that is given here today, Mr. Chairman.

Again, I would like to thank you very, very much.

[The written text of Mr. Mineta's statement follows:]

OPENING REMARKS BY HON. NORMAN Y. MINETA, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Thank you, Mr. Chairman, Congressman Edwards, for inviting me to these important hearings on H.R. 1007, and offering me this opportunity to explain my strong support for H.R. 1007.

H.R. 1007 is short, simple and direct—it is but ten lines long. Perhaps the brevity of H.R. 1007 is misleading, for this measure is an essential step toward solving one of the semiconductor industry's most serious problems: Chip pirating.

One of the loudest complaints we in government have heard in recent months has been that government is unable to carry out simple tasks in a timely and competent manner. The need for copyright protection for semiconductor chips, or integrated circuits, is critical. Yet this important protection has escaped the creators of semiconductor chips because of a technical classification dispute within government.

Quick enactment of H.R. 1007 could help solve this problem efficiently and effectively.

A thriving semiconductor industry is of tremendous importance to the people of the United States, of California, and to the people of San Jose and the Silicon Valley. The semiconductor chip, marketed commercially only since 1961, now represents a $5 billion global industry. Be it in the telecommunications or aerospace industries, or in home stereos and television games, the integrated circuit is a major part of our lives today. Of course, to the people of the Santa Clara Valley and elsewhere whose livelihoods depend on the semiconductor industry, the industry is that much more important. Yet, we have only begun to realize the potential of chip technology.

Chip technology is advancing so quickly that the full use by society of present chips will be restrained only by a more capable and efficient chip. How soon will we use a chip which holds one thousand times the information today's chip holds?

The cost of the search for a new, more powerful chip has escalated, and will continue to escalate, very rapidly. Yet, the tremendous investment required for this search is threatened by chip pirating. Chip pirates have become more sophisticated and adroit in quickly copying new chip patterns for another company's use.

And, Silicon Valley firms—firms which do much of the chip research and development—are faced with increasing uncertainty about their future ability to recoup their research and development investment. If chip pirating is allowed to continue unchecked, what happens to the incentive to invest in chip research and development?

Copyright protection has long been recognized in this country as vital to the operations of free trade and free enterprise. By not extending copyright protection to the creators of new semiconductor chip patterns, we in government could jeopardize the development of America's most promising growth industry.

I hope that today's hearings will bring out my point in more detail. I am sure you will agree that H.R. 1007 is not only vitally needed legislation, it is workable and effective legislation.

I caution you not to interpret H.R. 1007 as a government hand-out to the semiconductor industry. Rather, H.R. 1007 is a simple, long overdue, step toward ensuring fair competition in the development and marketing of semiconductor chips.

The problem is not overwhelmingly difficult, and the importance of H.R. 1007 is clear. Thus, let me stress the responsibility of Congress to act swiftly and decisively in passing H.R. 1007.

Thank you.

Mr. KASTENMEIER. We'll have a few questions, hopefully, for Mr. Baumgarten. He doesn't have to leave; therefore, he will be available for us for later questions if, as in the course of the testimony of other witnesses, questions arise which may seem appropriate for you to answer, will you be on hand, Mr. Baumgarten?

Mr. BAUMGARTEN. I'd be happy to remain, Mr. Chairman.

Mr. KASTENMEIER. I'd like to compliment you for your statement. It is thorough. Obviously, your office has spent more time studying this issue than we have in Congress—I'm talking about my own subcommittee at this point in time.

One of our difficulties is to determine what in fact different things mean, what are photographic masks, what are chips, and all the other technical or pseudo-technical terms used in connection with this. You have raised at the outset a number of issues, but it is difficult to know what we're talking about when we talk about schematic drawings or diagrams or mylar sheets and the application of the copyright law to these various terms.

Do I gather you to suggest that any contemplated legislative change would require definitions for some of these terms?

Mr. BAUMGARTEN. I think I'd like to defer an absolute answer to that until I hear some more of the testimony myself, Mr. Chairman. Our experience is not quite as limited as yours. We were at one point forced to develop more specific knowledge in the area when Intel Corp. brought an action against the Copyright Office, to force us to register chips. The action was dismissed without preju-

dice on the basis that the Copyright Office would hold a hearing in the area. We have, of course, deferred our hearing once you commenced hearings on Mr. Edwards bill.

The one point I think should be clarified during the questioning perhaps of some of the other witnesses is, are there differences between semiconductor chips and integrated circuit chips. And, of course, what does each term mean. There may be material covered under one term that is not covered under the other, or vice versa, and perhaps the word "semiconductor chips" belongs in the body of the bill rather than really in its title. I don't know. I would like to have the benefit of the additional testimony, as you would, sir.

Mr. KASTENMEIER. To your knowledge, is there any mention of prospective suits against the Copyright Office in this particular area? Is there any pending litigation affecting this area of coverage?

Mr. BAUMGARTEN. There are no copyright infringement actions that I am familiar with, Mr. Chairman. Whether there are unfair competition actions or patent infringements, or indeed, copyright complaints that have been filed but not brought to judgment, I don't know. I believe the answer is no, but I'm not sure.

Mr. KASTENMEIER. Other than the Copyright Act of 1976, for which the bill suggests amendment, are there any other recourses pursuant to law that organizations have, such as unfair competition, or other rights they might avail themselves of to protect what they presume to protect through such a bill?

Mr. BAUMGARTEN. Let me answer that with respect to—definitely with respect to different types of subject matter in the bill. With respect to the photographic masks, Mr. Chairman, the Copyright Office believes that they are proper subject matters of copyright protection under the preemption provision of the bill. That would essentially remove any possibility of unfair competition actions for mere duplication. There might be actions for trade secret piracy if a former employee would take the design away to a new employer, but simple duplication would be preempted.

On the other hand, with respect to the configuration of the chips or the patterns of the chips, since it is our belief those are not now subject matter of copyright protection, the preemption provisions would not apply and there would be a theoretical possibility of an action for misappropriation or unfair competition under State law. This was brought home rather clearly recently, if the Chairman will recall, as I referred to earlier, you're committee's decision to defer the possibility of typeface protection under the statute; since declaration of typeface protection was not protected, that would lead to the same conclusion that State law is not preempted and we now understand is in a magistrate's report in a Federal court action in the southern district of New York.

The court concluded that since your committee decided it was not proper subject matter of copyright, it could be—rights against duplication could be enforced under State law and the misappropriation action was sustained. The same type of reasoning might apply in this area.

Turning from state law, there is the possibility of patent protection either under the design patent statutes, or the mechanical, process patent statutes. As I suggested in my statement this is one

area we suggest the committee might look into, whether that's not sufficient. Of course, the standards of patent protection are much more severe than those of copyright protection. You have to show novelty uniqueness and improvement over the prior art, which is not required for copyright purposes.

We understand basically the desire to enact H.R. 1007 that that type of protection is apparently not perceived to be adequate; either the standards of novelty and invention are too high, or perhaps too cumbersome to obtain, or the cross-licensing, which we understand operates within the industry, makes for practical purposes the enforcement of patent rights not conducive to the type of relief that the proponents are seeking. I think again, the availability for patent protection is something perhaps addressed to some of the attorneys for the industry, and I'll be happy to respond again after I hear some of those.

Mr. KASTENMEIER. You, I think, alluded to the term, as in the question with typeface and design protection. Would it appear here that that the term "life plus 50 or 75 years" is too long or inappropriate for the protection of some of the interests sought to be protected here?

Mr. BAUMGARTEN. Subject to the same qualifications, Mr. Chairman, lack of expertise, I think there is good reason to believe it is too long and that even the proponents of this type of protection would concede that that is not the duration that they would require.

Mr. KASTENMEIER. At this point I'd like to yield, first to Mr. Edwards.

Mr. EDWARDS. Thank you, Mr. Chairman. I join my chairman in complimenting you, Mr. Baumgarten on your statement.

I only have one question, actually, and that is that you seem to make it very clear that these patterns on integrated circuit chips are not copyrightable today, is that correct, generally speaking?

Mr. BAUMGARTEN. In the judgment and practice of the Copyright Office, the configuration of the chip is not—if you were to depict these patterns on an earlier piece of paper, we believe that piece of paper and the drawing is copyrighted, but there are limitations on the rights extended thereby. But the chip itself, your statement is accurate.

Mr. EDWARDS. And in the opinion of the U.S. Copyright Office, you believe that with certain refinements that the bill should be enacted?

Mr. BAUMGARTEN. We believe that there should be a type of protection available to protect the chips that currently is not now the case. We are concerned that all the attributes now in the bill are not particularly appropriate to that type of protection and should be examined closer. This was the tradition of design protection.

Mr. EDWARDS. Thank you.

Mr. KASTENMEIER. The gentleman from California?

Mr. MINETA. Thank you, Mr. Chairman.

The significance between what is in the title of the bill, semiconductor chips, as differentiated from what's in the text of the bill itself, referring to integrated circuit chip, would you say that that is a question of definition that you want to——

Mr. BAUMGARTEN. Mr. Mineta, I've been given reason to believe that the integrated circuit chips covers a broader area subject matter than the phrase semiconductor chips, and whether it's broader or less, my only suggestion is that we find out the differences, and if so, decide which it is we want to protect, whether by definition or otherwise. Apparently, at least I've been told, there are differences; one is broader, one is more limited, and I just think we have to be consistent.

Mr. MINETA. Nevertheless, as far as the intention of what the legislation is trying to get at, you feel that that is something that ought to be enacted into law?

Mr. BAUMGARTEN. We could support the concept of protecting. I didn't mean to be picyune, and that was a minor portion, but we thought it was something that should be cleaned up in the early stage. But we do feel that there should be protection against this new type of duplication of these new devices. Whether it should be the type of protection that you would get from merely tacking on computer chips to the existing law, or whether you should tack on a few other limitations—for example, term it alike or something—I think we would like to consider first, together with your subcommittee after hearing additional testimony.

Mr. MINETA. Very quickly, just for my own edification, what's the difference between a published work and an unpublished work as it relates to, in this case, the chips?

Mr. BAUMGARTEN. The difference doesn't have the major difference it has under the old law. One particular difference might occur if a chip were considered not to be published it would be a difference of how long protection existed, because protection, assuming they are works made for hire, or works made under employment, 75 years from publication or 100 years from creation, whichever first expires. If they were never published, then you would have a straight 100-year term. There are other provisions sprinkled throughout the act which operate differently depending upon whether the work is published or not published. I think for this subject matter, and omitting any specific limitations and the like, none of these would really be major. The principal one would be in terms of protection.

Under the old law, it was an entirely different ball game, because there, whether it was published or unpublished was the fact that would determine whether you had Federal protection or not, but that difference between unpublished and published works has been removed with the enactment of the 1976 act.

Mr. MINETA. Except for the term, why would the U.S. Copyright Office then accept for registration an unpublished work and refuse for registration a published work?

Mr. BAUMGARTEN. I don't think that's an accurate statement of our practice, Mr. Mineta.

Mr. MINETA. Wasn't that a surrounding suit——

Mr. BAUMGARTEN. Yes, sir, but that was—and one of the reasons I think we joined with Intel in suggesting that the litigation was not the appropriate place to solve the question was that that was based upon the provision of the old law which had nothing to do with chips, really, or subject matter, which stated that if a work is registered in unpublished form you were required to deposit the

published version. They deposited the drawings, and we took them as I said we would. They then said that the chip itself was a published version of an unpublished drawing and we disagreed. We said, for example, if we took the drawing of a car as an unpublished drawing, we would not accept deposit of the car, or if we took the drawing of a refrigerator we would not accept deposit of the refrigerator. The fact that we accepted the drawing of the chip would not lead us to deposit the chip itself.

In other words, Mr. Mineta, we did not concede that the chip was a published version of the drawing, and I believe that your committee's actions in defining pictorial, graphic and sculptural work, and in fact expressed in your committee's report in 1976, this principle was in fact adopted. It's not a question of publication or nonpublication, it's a question of whether the drawing and the chip are the same thing, and we believe that in contemplation of the law they are not.

Mr. MINETA. Thank you very much.

Thank you, Mr. Chairman.

Mr. KASTENMEIER. Counsel, Mr. Mooney?

Mr. MOONEY. No questions.

Mr. KASTENMEIER. Mr. Lehman?

Mr. LEHMAN. Mr. Baumgarten, one of the questions that has come up is whether or not, assuming H.R. 1007 were enacted into law, designs of computer semiconductor chips could be used freely for purposes other than just flat copying. In other words, could you take them apart, examine their design by engineers, technicians, and have other companies copy the design for their own internal use and that sort of thing? I'd like you to comment on whether or not you think that H.R. 1007 as presently drafted offers that flexibility, or if it doesn't, whether it ought to be modified to provide for that kind of flexibility, for other uses, other than direct, flat copying.

Mr. BAUMGARTEN. If I had a clear answer, Mr. Lehman, I perhaps wouldn't have asked some of the questions I did ask.

Perhaps what you are suggesting was raised by Mr. Edwards in his remarks in the Congressional Record of October 14, 1978, at which time Mr. Edwards suggested that some of these uses for purposes of explanation, for purposes of examination for inhouse purposes, would fall within the scope of fair use and therefore would not be precluded by the terms of H.R. 1007. That's entirely possible. As the subcommittee is aware, however, fair use is not defined in the law. It would have to be developed by the courts on a case by case analysis, and although the type of remark extended by Mr. Edwards in the Congressional Record would certainly have effect, and I imagine the committee might wish, if it was to pass the bill, include it in the report language, it might considerably, the possibility that that would be an infringement might inhibit some type of dealing with chips that your committee does not wish to inhibit, and that's precisely the question I suggested the subcommittee explore. I don't have an answer, but I think what you've said is a very good example of the question I was raising.

Mr. LEHMAN. We could certainly draft some legislation which would provide for that?

Mr. BAUMGARTEN. You certainly could.

Mr. KASTENMEIER. Thank you very much, Mr. Baumgarten, for your splendid contribution, and we would appreciate it if you would be on hand if possible for comments or some further questions.

Mr. BAUMGARTEN. Thank you, Mr. Chairman, Mr. Edwards.

Mr. KASTENMEIER. At this point, the chair would like to greet its next witnesses, the distinguished president of Intel Corp., representing American Electronics Association, Western Electronics Manufacturers Association, Mr. Andrew Grove.

Mr. Grove will be accompanied by Roger Borovy, who is vice president and general counsel in Intel.

Also, I'm informed that Mr. L. J. Sevin, chairman of Mostek Corp., representing a similar point of view, will also form part of that panel.

Gentlemen, as far as your presentation is concerned, we are in your hands. You may proceed as you wish.

Mr. SEVIN. I am L. J. Sevin, I'm president of the Mostek Corp., and I'd like to point out that I'm from Texas.

Mr. KASTENMEIER. Where in Texas?

Mr. SEVIN. Carrollton, Tex.

We are inserting a slide in the order of presentation. It may come up wrong, we'll change it as it comes up. Mr. Chairman, I have a prepared statement.

Mr. KASTENMEIER. We have your statement. Did you wish to proceed from it?

Mr. SEVIN. Yes, I would.

Mr. KASTENMEIER. Please go forward, sir.

TESTIMONY OF L. J. SEVIN, PRESIDENT, MOSTEK CORP.

Mr. SEVIN. The proposed amendment will amend section 101 of the Copyright Act of 1976 to clarify that copyright protection is available for the imprinted design patterns on semiconductor chips.

At this point, maybe I should comment on the difference between semiconductor and integrated circuits. The semiconductor is merely a description of the material from which integrated circuits are made. All integrated circuits as we know them, and as we're talking here today, are semiconductor integrated circuits; however, all semiconductor circuits are not necessarily integrated circuits, the exception being there may be a semiconductor chip containing one transistor or one diode or one temperature sensing element, something of the like.

The Registrar of Copyrights has denied registration under the present act. She takes the position that these patterns cannot be identified separately from the utilitarian aspects of the chip.

The integrated circuit, a combination of transistors and other electronic circuit elements on a single chip of silicon—silicon being the semiconductor—was invented in the late 1950's. Commercial integrated circuits, known as IC's in our parlance, first were available in 1961.

Mr. KASTENMEIER. At the outset, may I ask you, Mr. Sevin, why the term "semiconductor"; why is it not a full conductor chip?

Mr. SEVIN. It means exactly what the term says. The silicon, for example, is neither a perfect, or are they perfect insulators, so they semiconduct. Now, pure silicon does conduct very small amounts of

currents, but it is a pretty good insulator. We have to do things to it to make it conduct electricity, and I hope to be able to clarify some of that as I go through here, and I may or may not succeed.

The technology expanded rapidly and in 1971, a then-small Santa Clara company produced an entire computer on a single silicon chip. The "computer-on-a-chip," technically called the microprocessor or microcomputer, is revolutionizing the electronics industry. The February 20, 1979, issue of Time magazine quoted an industry analyst as saying that the microcomputer chip, "Will have more impact on our society in the next 20 years than any other invention." Already, the microcomputer is being used in microwave ovens, refrigerators, electric ranges, cash registers, taxi meters, gas pumps, typewriters, television, et cetera, and by the end of this decade, we expect they will be found in virtually every home and business electronic unit produced.

To meet the 1980 pollution standards, for example, every automobile will have at least one microcomputer.

The integrated circuit was an American development. It was first marketed in 1961, and integrated circuits are already a $5 billion worldwide industry. Only over the last few years has foreign competition become a factor in the state-of-the-art, leading edge portion of the business. The microcomputer started from nothing in 1971. Last year's microcomputer sales were $235 million and are expected to grow 50 percent annually to exceed $800 million by 1981.

Continued development of integrated circuit memory chips has reduced the cost of information storage in computers a hundredfold in the last 10 years. In the late 20th and early 21st centuries, integrated circuitry will be as basic to an industrial economy as steel in the 19th and early 20th centuries. Leadership in this technology will be vital to any nation that will be a world leader in economic and military power.

Before I go on, I would like to introduce some of these materials to you. I have a simple glossary of terms. I'll be using the term "wafer." A wafer is a round disk of pure silicon. The substraights that we make our integrated circuits on—here are two examples—one is a wafer prior to being processed, before any integrated circuits have been imprinted, and another is a wafer after the integrated circuit has been printed. These disks are usually 2 to 4 inches in diameter. These happen to be 3 inches in diameter.

Another term we'll be using, and have used, is "chip." It's an individual circuit out of a wafer array, after wafer separation. And here's an example of an individual mounted package.

Now, the mask is a basic tool in the manufacture of integrated circuits. Here we have two examples. It's a square section of highly uniform glass or quartz containing an array of patterns that define one of several steps in the manufacture of an integrated circuit. There are several patterns or masks required to define a completed IC. The patterns on the glass are etched into a thin film of chromium or some other metallic substance. Steps in making a mask include the production of a "reticle," which is one of the array patterns, and a somewhat magnification that is a reticle [indicating].

A "master" is a reticle reduced and reproduced many times, and a "working plate" which is virtually the same as the master, is the final mask tool, and it is contact printed from masters.

Now, the term "layout," a layout is a drawing of the patterns contained on a mask, made at several hundred times the actual size of the integrated circuit.

Now, I have a very much expanded blowup of a small portion of an integrated circuit. This is at a different magnification at 100 times final size. It is a completed layout of an integrated circuit. Now, that layout is drawn by computer and it is a mere reproduction of a layout designer's work. I will also explain how that's done, later.

Now, we also have talked about schematic drawings, which are symbolic representation or abstractions of an integrated circuit. Here's an example of a very small portion of an integrated circuit. That is a schematic drawing [indicating].

The actual manufacture of integrated circuits is very difficult to explain and very difficult to understand if you are not thoroughly familiar with chemical processes or not very well versed in physics and chemistry, but I think I can give you a feeling for it, for this whole process in a very few minutes.

First of all, an integrated circuit is a microminiature structure comprised of several key materials. The basic material is highly pure single crystal silicon. The formation of circuit elements consists of selective introduction of controlled amounts of foreign elements into the silicon. We call these impurities, oxidation of the silicon, forming insulation films, and deposition of silicon and metal films to form connecting wires or other operations to introduce other materials to the silicon. All these materials exist in a micro-world that approaches the size of bacteria. This example, this slide, is an actual photograph, produced with a scanning electronic microscope, and it's a photograph of a single transistor in cross section within an integrated circuit. The magnification is about 30,000 times. The dark area at the bottom is pure single crystal silicon. The regions marked "N+ Diffusion" are the selected areas into which controlled amounts of impurities were introduced. The bright white region above is silicon oxide, an insulating layer, the dark regions marked "Poly I" and "Poly II" are deposited silicon films, and the thick topmost gray region is an aluminum film.

Now remember, this is one transistor is one transistor, and the magnification is 30,000.

Here is an example of an entire integrated circuit that contains about 5,000 transistors. The magnification now is only about 100; then at a still lower magnification of about four and one-half you see here examples of two different wafers containing different sized circuits.

The patterns on these wafers were introduced through the use of several successive masks in a process very similar to the taking and developing of pictures. The process requires a very clean, particle-free environment containing much complex and expensive processing equipment. Patterns on masks are projected into an emulsion film on the wafers from a light source with a machine called a projection printer. The "picture" of the mask on the wafer is developed through regular dark room developing techniques, the

purpose being to delineate areas in which to etch holes in oxides or to remove unwanted parts of deposited silicon or metal with suitable acids. After each acid etch a long rinse in very pure water is necessary.

To get oxides and silicon films on wafers in the first place, they are put into furnaces at very high temperatures in different gaseous atmospheres. Oxides grow in oxygen, obviously, and silicon films are deposited from the reactions of certain other gases.

Thin aluminum films can be deposited by vaporization of pure aluminum in a vacuum chamber. Here you see wafers being loaded onto a rack prior to being loaded in the vacuum chamber.

And that's basically all there is to it. That, admittedly is a very broad-brush treatment, but I think, as I said, there should be some flavor for the complicated process of producing integrated circuits.

Now, I'd like to get to the key part of this presentation, the process of designing the masks. It starts with the circuit design concepts developed by highly skilled and creative engineers, usually electrical engineers, making heavy use of computer analysis and simulation. The product of these circuit design engineers is some form of logic or schematic drawing, examples of which you have before you. The drawing is documentation of the product in abstract or symbolic form.

A layout designer takes over at this point and turns an abstraction into an engineering drawing of a mask. Here is a small section of a mask layout [indicating]. Now, this is done mostly by hand, and it involves much trial and error and is one of the most difficult and time-consuming parts of the development. The largest drawings are usually done at a magnification of 500 to 1,000 times and have to be done in sections because of the practical limitation of drafting tables. Just how small a part of an integrated circuit that is will become apparent to you in a later slide.

These drawings also have to be dimensionally quite accurate so that the drawing is done on a very stable mylar film. There is an example of mylar films that Mr. Borovoy will show you.

Special computer graphic software provides for the entry of the drawing—I'm sorry—here's a layout designer at work and a closeup shot of the layout designer's work.

Special computer graphics software provides for the entry of the drawing into a computer through the use of a machine called a digitizer. The digitizer has a specially constructed table having a grid of many fine wires hidden under the surface. The drawing is converted into a series of points against some common reference. An electromagnetic coil with cross hairs communicates with the hidden grid wires to pinpoint exact locations.

The drawing can be displayed on a TV screen for editing purposes. The product of the digitizer is a magnetic tape which can be used to drive a computer controlled drafting machine for engineering checks. The small drawing I passed out is a computer controlled drawing, and it is simply nothing more than a reproduction of an original mask drawing at a different magnification.

Finally, a machine called a pattern generator which reproduces the mask in a thin emulsion film on a glass or quartz plate in a photographic dark room. This will become the reticle that I intro-

duced earlier. A few more similar steps will result in the working masks with arrays of circuits on them.

Now, why is this layout important? The "chips" we have been discussing are becoming larger, more complex and increasingly expensive to develop. Computer memory chips in 1971 were approximately one-tenth of an inch on each side and contained about 2,000 transistors. The state-of-the-art memory chips being developed in 1979 measure about 5/32 by 1/4 inch and contain approximately 70,000 transistors. A microcomputer chip of 1971 also contained about 2,000 transistors, while the state-of-the-art microcomputer chip of 1979 contains over 30,000 transistors. It is more powerful than the IBM 1401, which was the workhorse business computer of the 1960's. The chip layout design on each of these circuits almost fills a room 20 feet square. Five designer years were required for the memory and 10 designer years were required to transform the microcomputer into a chip layout. In either case this time is by far the longest part of the development cycle of new products, longer than the engineering time that went into conceptualizing the product, and much longer than the time taken by the routine computer operations necessary to produce a mask.

Who are layout designers? 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 does 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 of the product. Layout design is a skill that has successfully resisted 12 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.

At the same time as the cost of creating new layout designs is skyrocketing, the technology for copying them is improving. Ironically, electronic equipment making use of these very microcomputer chips is being used by chip pirates to copy them. Better lenses, better photomicrographic techniques, better control electronics are becoming available for taking superb blowup pictures of the tiny chip. As soon as the company which did the original design puts a chip on the market, the chip pirate purchases it, removes any impeding coatings on the chip surface, and sends it to a photomicrographics specialist to make a blowup photo of the layout design. Typically, a blowup 800 to 1,000 times the original chip size is used. The chip pirate, or a commercial business which offers chip copying as a service, electronically traces the photographic blowup and feed the design information into a computer in exactly the same way as the original digitizer did from the original layout drawings. The techniques and equipment are exactly the same.

To demonstrate that chip pirates do exist, I have a slide of one of my company's products. It's a 16,000 bit random access memory. I'd like to do one thing on this slide: There are a couple of small rectangular areas on either corner of the chip here. I don't know if

you can see them, but they serve no function at all. They're merely an engineering oversight in that particular revision. The engineer forgot to take them off the mask. Now, this is the 16K Ram of one of our august competitors, and you see that they've designed this function into the chip as well. Here's another 16K Ram from another competing company and you can see that at least they had the sense to take the useless geometries off the chip. But these all overlay each other exactly. We've had much larger blowups and they fit line by line.

Mr. EDWARDS. How did you get those?

Mr. SEVIN. We bought them from distributors. That's how they got ours originally.

Now, if direct copying of an integrated circuit is not an available alternative, the chip pirates, I believe, cannot exist. These circuit designs are so intricate and complicated, especially the leading edge products of today, that any attempt to make geometrical changes in the layout just for the sake of change will meet with disaster. The only way this can be done safely is for the copier to gain a thorough technical understanding of the circuit so that an alternative layout can be made to work. This requires a lot of patient studying by sophisticated engineers and is known as "reverse engineering." Oftentimes reverse engineering can consume nearly as much time and effort as the original development did, and oftentimes reverse engineering produces an improved product over the original. We have no quarrel with that at all. It is fair game.

Line-by-line copying, however, is quick, cheap, and allows a competitor unfair advantage by drastically cutting short development time and expenses. For example, our company spent over 2 years and over $3 million developing the 16,000 bit Random Access Memory to the producible product shown in an earlier slide. There is a company in Japan that can be hired to copy it in less than 3 months for less than $50,000. The proposed amendment to section 101 of the Copyright Act of 1976 will provide our industry protection against this sort of thing.

Thank you for the opportunity to testify today.

Mr. KASTENMEIER. Thank you very much, Mr. Sevin, for that, I think, illuminating explanation. I'm not sure I do understand it entirely. It does give us an idea.

Do most, if not all, chips in terms of industrial use end up in computers or in computer functions of other, larger devices?

Mr. SEVIN. A very large percentage of them do, yes. But there are many—by the same token, there are many applications in noncomputer usage. There again, it depends on what you define a computer to be. Most electronic controlled circuitry in use today is usually connected in that it could be described as a computer, but if you define a computer to be a stand-alone instrument for the processing of data, the controlled processes, or something like that, the answer to that is that there are a lot of other applications. The majority are in computers.

Mr. KASTENMEIER. You indicate that your company is a Texas company?

Mr. SEVIN. Yes.

Mr. KASTENMEIER. Consequently, while much of the industry is here, it's not all here, I take it.

Mr. SEVIN. Although we will quarrel with the statement that the center of the industry is here.

Mr. KASTENMEIER. What is the replication or duplication of circuitry called piracy in your statement, and generally there was a reference to "chip pirates," do I understand then that all reputable manufacturers here and in Texas and elsewhere do not copy their competitors?

Mr. SEVIN. That's not correct. These pictures are——

Mr. KASTENMEIER. I'm trying to determine whether it's a moral problem or just an economic problem.

Mr. SEVIN. I'm trying to relate it to a similar process, which I think it's similar to, copying tapes. That's a term apparently used by the Copyright Office.

Mr. KASTENMEIER. Although I think it's probably true that major record or tape manufacturers in the country could not and have not heretofore copies other makers.

Mr. SEVIN. I think it's clearly against the law, as well. In this case——

Mr. KASTENMEIER. Well, it may not have been, but it certainly is now. But the state of affairs within the industry presently is that it is fair game to copy your competitors' work if it's superior?

Mr. SEVIN. That's been the case.

Mr. GROVE. May I cut in? It's not my turn yet, but can I answer this question? I'm Andrew Grove. I will be the next person here.

The industry, various members of the industry, from time to time, have resorted to copying along the lines that Mr. Sevin indicated. Whether that is a reputable practice or not somewhat depends on the eye of the beholder. There are companies that would not do that. Mr. Sevin's company, to my knowledge, has never done it; our company to certain knowledge of mine has never done it. The lesser novelty segment of the industry feels it necessary to resort to it periodically. It is not regarded as a reputable practice by many of us in the industry.

Mr. KASTENMEIER. Maybe at this point, instead of asking further questions, I should encourage you, Mr. Grove or Mr. Borovoy to delivery your testimony, then I'll ask further questions.

[The prepared statement of Mr. Sevin follows:]

STATEMENT OF L. J. SEVIN

INTRODUCTION

The proposed amendment will amend Section 101 of the Copyright Act of 1976 to clarify that copyright protection is available for the imprinted design patterns on semiconductor chips. The Registrar of Copyrights has denied registration under the present Act. She takes the position that these patterns cannot be identified separately from the utilitarian aspects of the chip.

The integrated circuit, a combination of transistors and other electronic circuit elements on a single chip of silicon, was invented in the late 1950s. Commercial integrated circuits (known as "ICs") first were available in 1961. The technology expanded rapidly and in 1971 a then small Santa Clara company produced an entire computer on a single silicon chip. The "computer-on-a-chip", technically called the microprocessor or microcomputer, is revolutionizing the electronics industry. The February 20, 1979 issue of *Time* magazine quoted an industry analyst as saying that the microcomputer chip, "will have more impact on our society in the next twenty years than any other invention". Already, the microcomputer is being used in microwave ovens, refrigerators, electric ranges, cash registers, taxi meters, gas

pumps, typewriters, television sets, hi-fi's, home computers, and, by the end of this decade, probably will be found in virtually every home and business electronic unit produced. To meet the 1980 pollution standards, for example, every automobile will have at least one microcomputer.

The integrated circuit was an American development. First marketed in 1961, ICs are already a $5 billion worldwide industry. Only over the last few years has foreign competition become a factor in the state-of-the-art, leading edge portion of the business. The microcomputer started from nothing in 1971. Last year's microcomputer sales were $235 million and are expected to grow 50% annually, to exceed $800 million by 1981.

Continued development of integrated circuit memory chips has reduced the cost of information storage in computers a hundred fold in the last ten years. In the late 20th and early 21st centuries integrated circuitry will be as basic to an industrial economy as steel in the 19th and early 20th centuries. Leadership in this technology will be vital to any nation that will be a world leader in economic and military power.

GLOSSARY OF TERMS

As an aid to better understanding of this presentation, I would like to spend a minute or two defining and giving examples of some of the key terms we will be discussing.

Wafer—Round disc of nearly pure silicon—the "substrates" upon which integrated circuits are produced. Examples.

Chip—An individual circuit out of a wafer array, after wafer separation. Example mounted in package.

Mask—Basic tool in the manufacture of integrated circuits. A square section of highly uniform glass or quartz containing an array of patterns that define one of several steps in the manufacture of an IC, there being several patterns or masks required to define a completed IC. The patterns on the glass are etched into a thin film of chromium or some other metallic substance. Steps in making a mask include production of a *reticle,* one of the array patterns, a *master* the reticle reduced and reproduced many times, and a *working plate* the master contact printed.

Layout—Drawing of the patterns contained on a mask, made at several hundred times actual size of integrated circuit.

Logic Drawing/Schematic Drawing—Symbolic representation of integrated circuit.

SUMMARY OF WAFER PROCESSING

The actual manufacture of integrated circuits is very difficult to explain to those not thoroughly familiar with it. But I think I can give you some feeling for the whole process in a very few minutes.

First of all, an integrated circuit chip is a microminiature structure comprised of several key materials. The basic material is highly pure single crystal silicon. The formation of circuit elements consists of selective introduction of controlled amounts of foreign elements into the silicon, (We call these impurities), oxidation of the silicon, forming insulation films, and deposition of silicon and metal films to form connecting wires or other material. All these materials exist in a micro world that approaches the size of bacteria. Example, this slide is an actual photograph, produced with S.E.M., of a single transistor in cross section within an integrated circuit. The magnification is about 30,000. The dark area at the bottom is pure single crystal silicon. The regions marked "N+ diffusion" are the selected areas into which controlled amounts of impurities were introduced. The bright white region above is silicon oxide, an insulating layor. The dark regions marked "Poly I" and "Poly II" are deposited silicon films, and the thick topmost gray region is an aluminum film. Now remember, this is one transistor and the magnification is 30,000. Here is an example of an entire integrated circuit that contains about 5,000 transistors. The magnification now is only about 100, then at a still lower magnification of about four and a half you see examples of two different wafers containing different sized circuits.

The patterns on these wafers were introduced through the use of several successive masks in a process very similar to taking and developing of pictures. The process requires a very clean particle-free environment containing much complex and expensive processing equipment. Patterns on masks are projected into an emulsion film on the wafers from a light source with a machine called a projection printer. The "picture" of the mask on the wafer is developed through regular dark room developing techniques, the purpose being to delineate areas in which to etch holes in oxides or to remove unwanted parts of deposited silicon or metal with suitable acids. After each acid etch a long rinse in very pure water is necessary.

To get oxides and silicon films on wafers in the first place, they are put into furnaces at very high temperatures in different gaseous atmospheres. Oxides grow in oxygen, obviously, and silicon films are deposited from the reactions of certain other gases.

Thin aluminum films can be deposited by vaporization of pure aluminum in a vacuum chamber. Here you see wafers being loaded prepared for the vacuum chamber.

And that's basically all there is to it.

DEVELOPMENT OF MASKS

And now we get to the key part of this presentation—the process of designing masks. It starts with the circuit design concepts developed by highly skilled and creative engineers—usually electrical engineers—making heavy use of computer analysis and simulation. The product of these circuit design engineers is some form of logic or schematic drawing, examples of which you have before you. The drawing is documentation of the product in abstract or symbolic form.

A layout designer takes over at this point and turns an abstraction into an engineering drawing of a mask. This is done mostly by hand, involving much trial-and-error and is one of the most difficult and time consuming parts of the development. The largest drawings are usually done at a magnification of 500 to 1000 times and have to be done in sections because of the practical limitation of drafting tables. They also have to be dimensionally quite accurate so the drawing is done on a very stable mylar film.

Special computer graphics software provides for the entry of the drawing into a computer through the use of a machine called a digitizer. The digitizer has a specially constructed table having a grid of many fine wires hidden under the surface. The drawing is converted into a series of points against some common reference. An electromagnetic coil with cross hairs communicates with the hidden grid wires to pinpoint exact locations.

The drawing can be displayed on a TV screen for editing purposes. The product of the digitizer is a magnetic tape which can be used to drive a computer controlled drafting machine for engineering checks, and finally a machine called a pattern generator which reproduces the mask in a thin emulsion film on a glass or quartz plate in a photographic dark room. This will become the reticle. A few more similar steps will result in the working masks with arrays of circuits.

IMPORTANCE OF THE LAYOUT

The "chips" we have been discussing are becoming larger, more complex and increasingly expensive to develop. Computer memory chips in 1971 were approximately one-tenth inch on each side and contained about 2000 transistors. The state-of-the-art memory chips being developed in 1979 measure about five thirty seconds by one quarter inch and contain approximately 70,000 transistors. A microcomputer chip of 1971 also contained about 2000 transistors while the microcomputer chip of 1979 contains over 30,000 transistors. It is more powerful than the IBM 1401—the workhorse business computer of the 1960s. The chip layout design on each of these circuits almost fills a room 20 feet square. Five designer years were required for the memory and ten designer years were required to transform the microcomputer into a chip layout. In either case this time is by far the longest part of the development cycle of new products, longer than the engineering time that went into conceptualizing the product, and much longer than the time taken by the routine computer operations necessary to produce a mask.

WHO ARE THE LAYOUT DESIGNERS?

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 does 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 of the product. 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!

At the same time as the cost of creating new layout designs is skyrocketing, the technology for copying them is improving. Ironically, electronic equipment making use of these very microcomputer chips is being used by chip pirates to copy them! Better lenses, better photomicrographic techniques, and better control electronics are becoming available for taking superb blow-up pictures of the tiny chip. As soon

as the company which did the original design puts a chip on the market, the chip pirate purchases it, removes any impeding coatings on the chip surface, and sends it to a photomicrographics specialist to make blow-up photos of the layout design. Typically, a blow-up 800–1000 times the original chip size is used. The chip pirate (or a commercial business which offers chip copying as a service) electronically traces the photographic blow-up and feeds the design information into a computer in exactly the same way as the original digitizer did from the original layout drawings. The techniques and the equipment are exactly the same.

To demonstrate that the chip pirates do exist, I have a slide of one of my company's products—the 16K Ramdom Access Memory.

Now if direct copying of an integrated circuit is not an available alternative, the chip pirates cannot exist. These circuit designs are so intricate and complicated that any attempt to make geometrical changes in the layout just for the sake of change will surely meet with disaster. The only way this can be done is for the copier to gain a thorough technical understanding of the circuit so that an alternative layout can be made to work. This requires a lot of patient study by sophisticated engineers and is known as "reverse engineering". Oftentimes reverse engineering can consume nearly as much time and effort as the original development did, and oftentimes reverse engineering produces an improved product over the original. We have no quarrel with that. It's fair game.

Line-by-line copying, however, is quick, cheap, and allows a competitor unfair advantage by drastic cutting short development time and expenses. For example, our company spent over two years and over $3 million developing the 16K RAM to the producible product shown in an earlier slide. There is a company in Japan that can be hired to copy it in less than three months for less than $50 thousand. The proposed amendment to Section 101 of the Copyright Act of 1976 will provide our industry protection against this sort of thing.

Thank you for this opportunity.

TESTIMONY OF ANDREW S. GROVE, PRESIDENT, INTEL CORP., ACCOMPANIED BY ROGER BOROVOY OF INTEL

Mr. GROVE. Mr. Chairman, I would like to submit through evidence the written version of this testimony which you, I believe, have in your hand.

Mr. KASTENMEIER. Without objection that testimony you refer to will be received and made a part of the record.

[The written text of Mr. Grove's statement follows:]

STATEMENT OF ANDREW S. GROVE ON BEHALF OF THE AMERICAN ELECTRONICS ASSOCIATION

Andrew S. Grove received his Ph.D. in Chemical Engineering from the University of California at Berkeley. Dr. Grove is the author of a leading text on semiconductor physics. This week, he will be installed as President of Intel Corporation.

AEA (formerly WEMA) is a trade association representing more than 1,000 high-technology electronics companies in 39 states. While some of our member companies are among the largest firms in the United States, the majority are smaller businesses employing fewer than 200 employees. Most of our member firms design and manufacture sophisticated components and equipment for a number of end markets.

HIGH TECHNOLOGY INDUSTRIES DEPEND ON AGGRESSIVE R. & D. SPENDING

The high-technology electronics industries, of which the semiconductor industry is an integral part, play an increasingly important role in the U.S. economy. Our products are being used in a wide and growing variety of business, military, scientific and consumer applications that, by extending the powers of the human body and intellect can improve productivity and the quality of life. Our industries provide an ever-growing number of jobs and exports. A 1977 AEA survey of 325 of its member companies showed employment of 750,000 people in the U.S. In 1977 high-technology consumer electronics-oriented exports were $8.92 billion (source: U.S. Department of Commerce).

This industry was created, and its growth powered, by aggressive investment in research and development. Its future growth is dependent, if anything, even more strongly on continued heavy research and development spending.

It is in this context that I address H.R. 1007, which amends the Copyright Act of 1976. This bill will provide copyright protection to the semiconductor chip designs

and thereby maintain the incentive for firms to devote large resources to design and development.

SEMICONDUCTOR R. & D. COSTS SKYROCKET

One of the trends of the most advanced segment of the semiconductor industry is the exceedingly rapid growth of the cost of designing new products. This trend is shown in the first attachment, which is taken from the Keynote Speech at the 1979 International Solid State Circuits Conference, by Gordon E. Moore. It can be seen that while ten years ago a typical semiconductor integrated circuit took about ten person-months to design, the typical product today requires the expenditure of about 200 person-months—a 20-fold increase! Since the expense required for a person-month of design effort has also been steadily increasing, it is clear that the cost of semiconductor integrated circuit design has been—and will continue—growing at a dizzying rate. As a rough estimate, a 200 person-month effort costs in the neighborhood of $1,000,000.

No prudent management can authorize the expenditure of this kind of development sums unless the resulting product is protected from pirating by competitors desirous of taking a free ride. I shall provide some recent examples of this practice.

CHIP PIRATING ON THE RISE

The next attachment shows one of Intel's most important, advanced technology products—the 2147 4K static Random Access Memory (RAM). This product, the result of very extensive R&D work, enabled Intel's innovative Metal-Oxide-Silicon (MOS) technology to invade the marketplace formerly held by older bipolar products. IBM made their first purchase of memory systems from an outside supplier ever because of the unique characteristics of this memory component.

Intel introduced the 2147 in mid-1977 and has not, until recently, seen any competition. The first competition which recently appeared is a photographic duplicate manufactured in Japan by Toshiba. The attachment shows the Intel and Toshiba chips next to each other; clearly, the Toshiba device is a straight copy of the Intel device.

The next attachment shows a Russian copy of an Intel 4K dynamic RAM integrated circuit. To be sure, passage of the Edwards, Mineta and McCloskey bill into law in the United States will not prevent the Russians from copying in Russia. At least, however, it will prevent the Russians from exporting their illicit copies to the United States, and as Russian technology enters the 20th century it will become necessary for them, more and more, to conform their laws to ours to obtain exports.

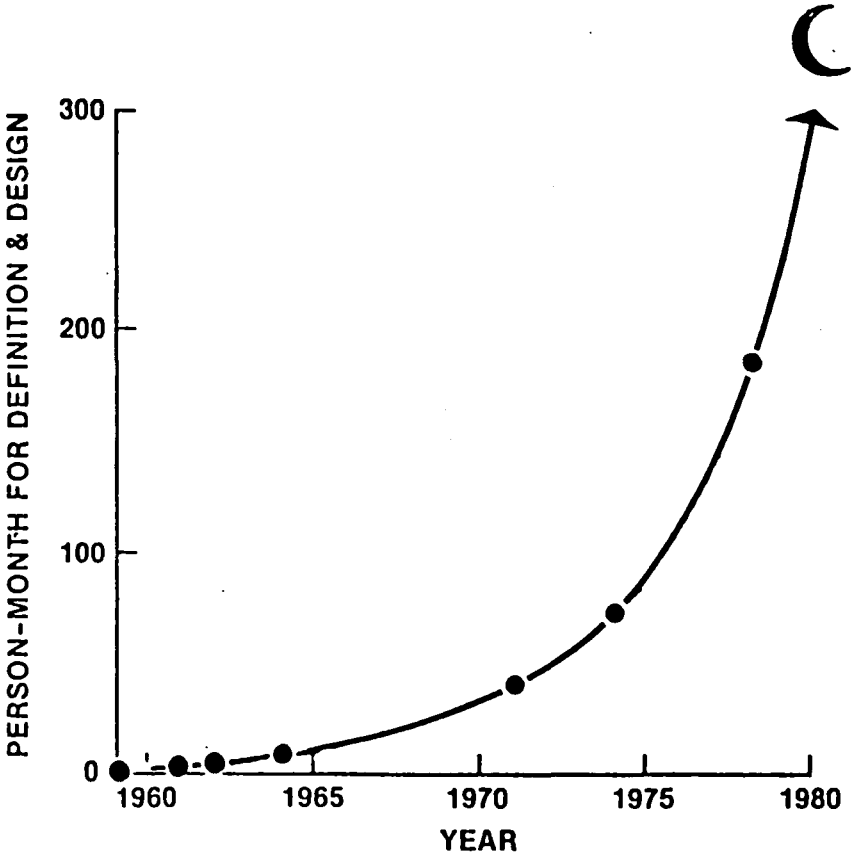
As I illustrated earlier, due to the extremely rapid increase in the cost of development of advanced semiconductor integrated circuits, the temptation for chip pirating, and the damage to the developer coming from such chip pirating, will inevitably increase unless protection is provided by the Congress. So far, companies such as Intel, Mostek, and other American semiconductor companies who spend huge sums on otherwise unsupported research and development have been able to reap the benefits of their ingenuity, and their shareholders, as well as our entire society, have been well served. But the inevitable rise of "chip pirating" does not augur well for the future. Chip pirates curtail the innovators' product leadtime (during which development costs can and must be recovered) by quickly reaping where the innovators have sown. If we lose the early profits from our designs to the chip pirates, funds available for development will be curtailed, and our industry will lose its technology lead. The semiconductor industry is a substantial exporter. We would suffer in balance of payments, stability of the dollar, and even in superiority of our military equipment as a result of loss of our semiconductor technology leadership position.

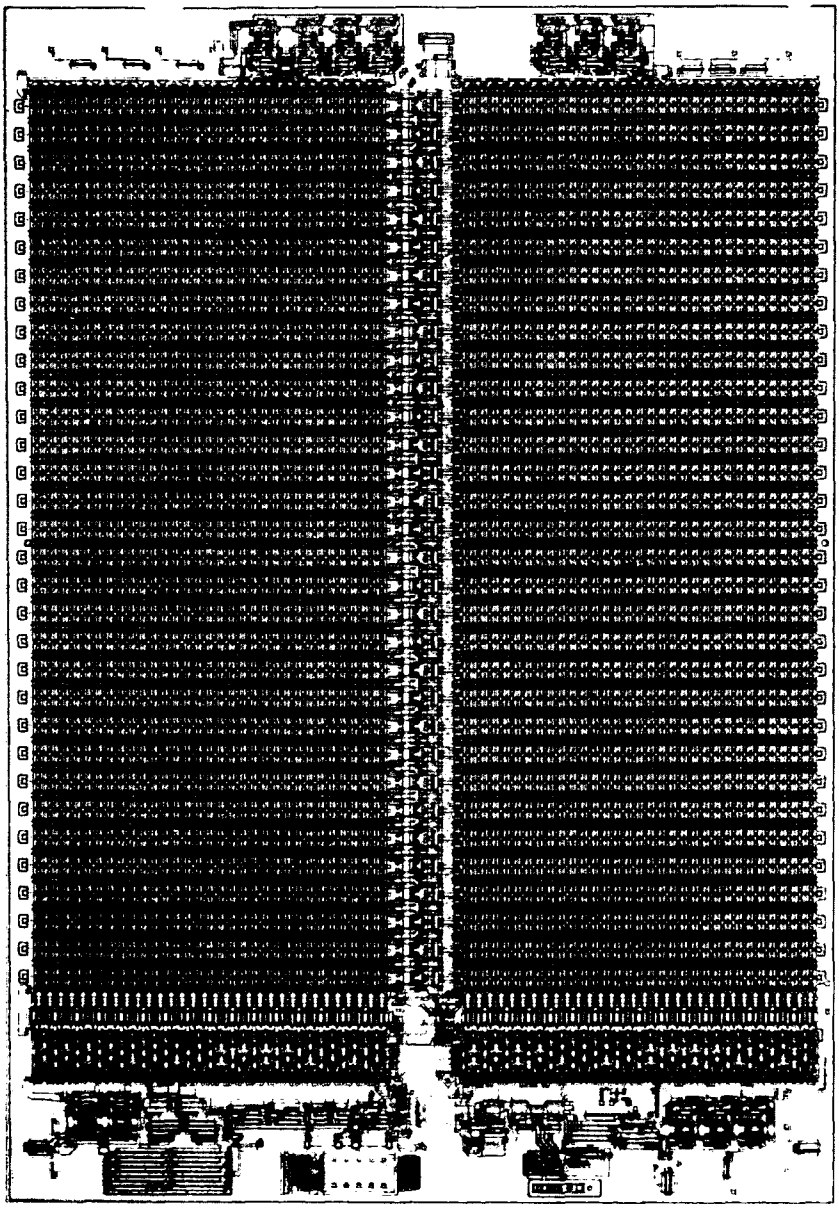
JAPANESE CHIP PIRATING PARTICULARLY DANGEROUS

If the pirating is done by the Japanese, the effect is doubly serious. The Japanese already have major competitive advantages: cheap money and a home market protected by tariff and non-tariff barriers to American exports. If we also allow them to help themselves to American technology by copying rather than having to do their own topographic designs, they will be handed the opportunity to take America's most successful high technology business away.

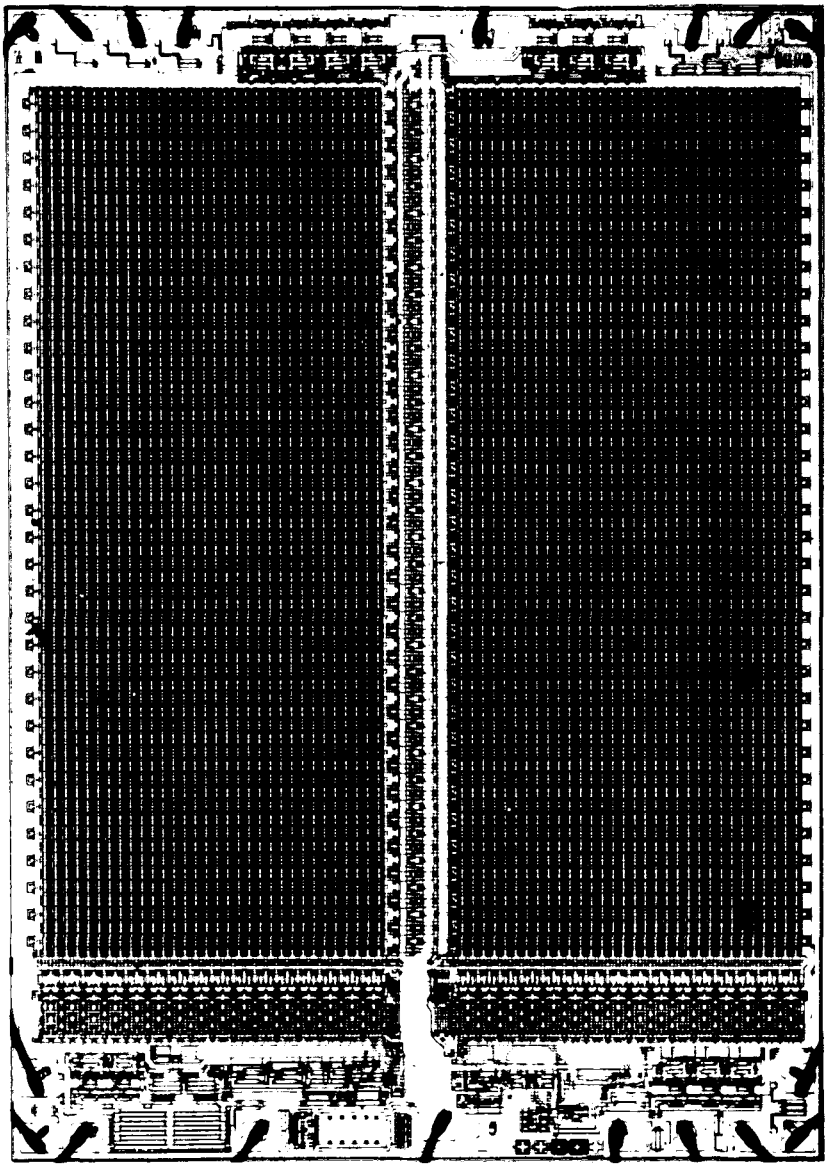
Patents are not enough to protect us. The Japanese make their share of patented "inventions." Since the American companies need licenses under the Japanese inventions in the same manner as the Japanese need licenses under the American inventions, patent exchanges have been the norm. On the other hand, to my knowledge, no American semiconductor company has ever made an unlicensed copy of a Japanese chip. If copyright protection is available, companies can exchange designs and receive a benefit back from a licensed copier.

In summary, if the semiconductor industry is to continue on its enormously successful path of providing jobs and exports, helping us conserve energy, and improving the quality of our lives in many other ways, it must have the assurance that its gigantic investment in research and development will have a chance to pay off: it needs protection from chip pirating!

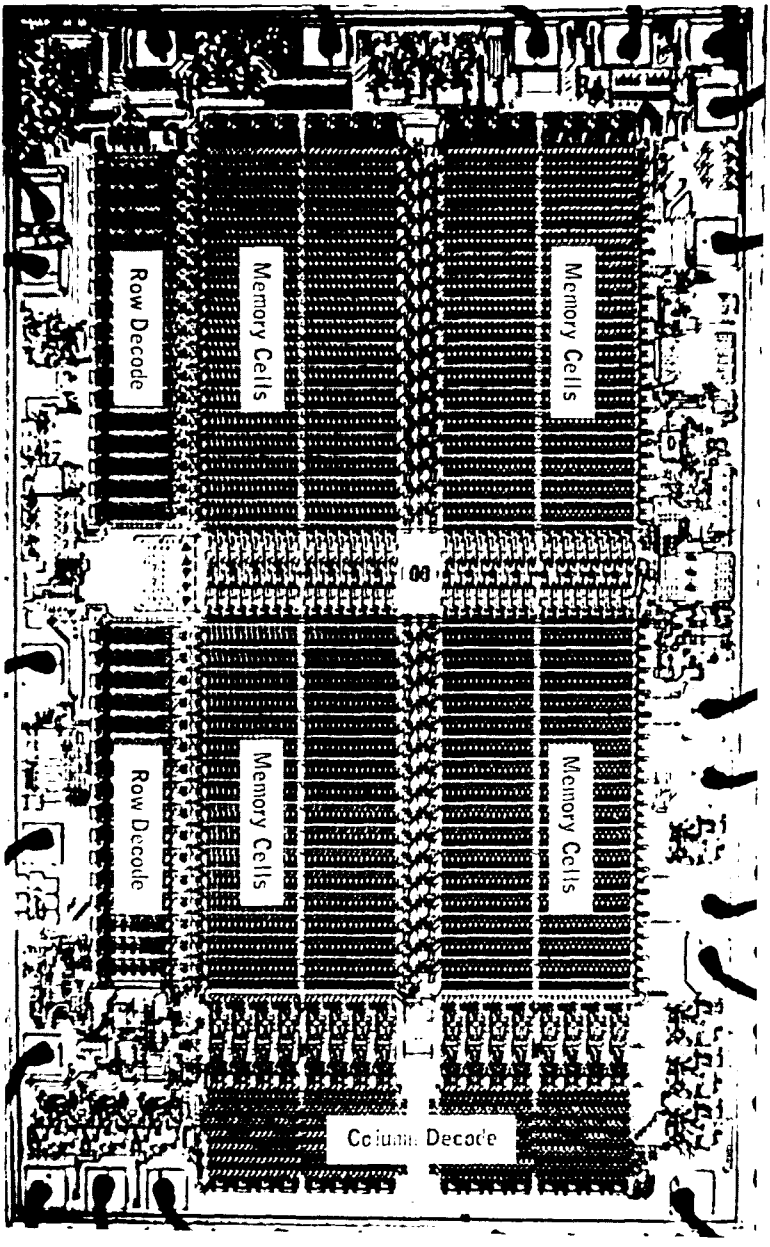




Intel 2147

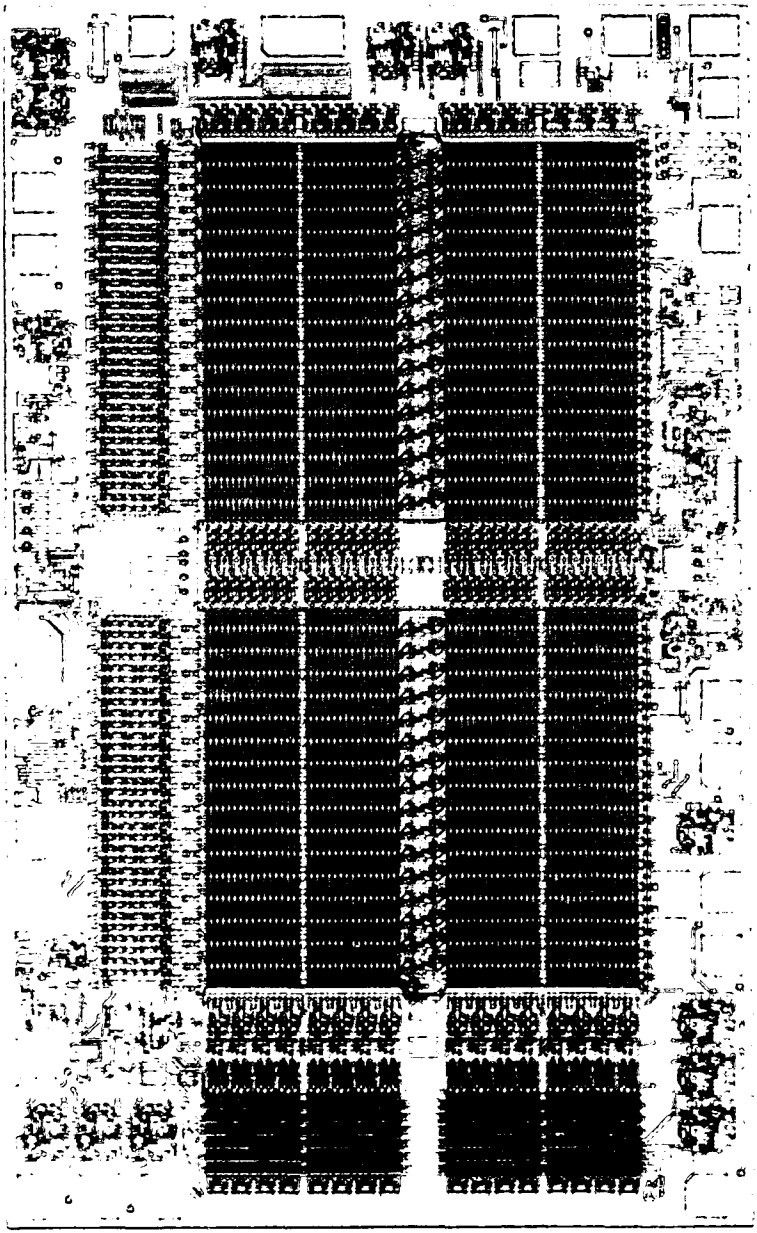


Toshiba 2147



Russian 2107B

(source: Aviation Week Magazine)



Intel 2107B

Mr. GROVE. With that, I would like to depart from that written statement a little bit, rather than follow it point by point, and try to highlight the exact messages that I am trying to convey there, if I may do so.

Mr. KASTENMEIER. Actually, Mr. Grove, you have a very short statement. We will be pleased to receive it for the record, together with its attachments.

Mr. GROVE. By way of introduction, it is very generally recognized by those of us in the industry, in the industry in a broader sense in the electronic and high technology industry, that essentially everything that has happened in the last two decades in terms of electronics and high technology endeavors have been fueled by the development of the semiconductor business, semiconductor industry, our industry, the industry you've heard described.

The driving force for these developments has been the phenomena of absolutely, steadily, predictively dropping prices, and dropping costs of electronic functions. Mr. Sevin used electronic memories, the capability of storing numbers, as an example. The cost of storing one number that we refer to in the lingo of the industry as one bit of memory, has dropped by something like between one hundred and one thousandfold in the last 10 years. There is no magic involved with this. We operate in the same inflationary economy as everybody else. We use a certain amount of automation, but it's a very, very miniscule contribution to this cost reduction. The basic method for this gigantic cost reduction has been, and continues to be achieved, is putting more and more functions into a little package like you have on your desk; putting a larger and larger number of functions, bits of storage into the same package.

At the risk of some oversimplification, if you look at that package, a package like that has always cost about the same amount of money to make, roughly. Ten years ago or twenty years ago there was one transistor in it, and it cost less than $20 to make. Today, there are 30,000 to 40,000 transistors in it, and it costs about $20 to make.

Mr. KASTENMEIER. Quite apart from content, Mr. Grove, does the industry generally follow the industrial processes described by Mr. Sevin, in fact illustrated by Mr. Sevin? Because the steps look very complex. It would not necessarily follow that everybody used precisely the same technology to achieve the same results. Is there much difference in industrial processes?

Mr. GROVE. Between one company and another?

Mr. KASTENMEIER. Between one company and other.

Mr. GROVE. There is always some difference, which is why some companies do better in certain product areas than others. The differences relative to the complexity you saw displayed in the slides are minor, but at a given time those minor differences are somewhat corresponding to a racing car turning a corner or a sedan turning a corner. They both turn, they both have four wheels, but one of them is going at the edge of its ability. The differences are kind of subtle. If you look at them far away, they are both automobiles. In that sense the processes are always different. But all competitors seem to be marching along and improving their capabilities as time goes on.

Mr. KASTENMEIER. Are those processes in part or in whole covered by patient protection?

Mr. GROVE. In part they are covered by patent protection; in whole, they cannot be. There is a great deal left that is unpatentable and sometimes it is better served by not being patented.

If I may continue:

The flip side of this gigantic increasing technological complexity as we put a larger and larger number of functions into a given package, is that the cost of design has literally skyrocketed. It has not increased in proportion to the number of components that you are trying to fit in. Just like a jigsaw puzzle, the time to take to put a jigsaw puzzle together increases more rapidly than the number of pieces in a jigsaw puzzle. You try to put a 100-piece puzzle together and a 500-piece puzzle together, the 500-piece puzzle will take more than five times to put together. It is a very analagous process. The design process that Mr. Sevin described is very much like putting jigsaw puzzles together, because you have to put these components in close proximity to each other, have to make them fit.

Because of that, increase in the time taken to do design, integrated circuit design, has absolutely skyrocketed. I have a real-life illustration, it so happens, from the keynote speech at the most prestigious industry-wide conference that took place 2 months ago in Philadelphia, which is called the International Solid State Circuits Conference. I borrowed this illustration from there, and it shows, on the vertical axis, the number of person-months required for the definition and design of the typical product of the time. And down below I'm showing the time starting from 1960 where it was almost immeasurable, and as you can see, in the late 1970's, we are dealing with something in excess of 300 man-months of design work.

To scale that a little bit, a very off-the-cuff estimate would be—of course, you have to consider at the same time that this phenomena is taking place, the cost of designers per person-month is also going up—the skills required are going up, there's inflation going on, so the actual cost is rising even faster than that. A typical cost of a typical product today—and that is not the state-of-the-art product—a typical product would be maybe in the 200 to 250 person-months development cycle, maybe $1,000,000 expenditure. More extreme cases today—one example I think Mr. Sevin referred to here, he quoted $3,000,000—we have, unfortunately, run into $10,000,000 bills. This is just the design of the particular product, nothing to do with the actual processing sequence that you saw on those slides, or the complexity of the processes.

Mr. KASTENMEIER. Would you, or have you reached a certain plateau in that regard, limited by human resources in a sense, using your analogy to the jigsaw puzzle, whereupon it will take a computer in fact, something about human capability, to reach another level of difficulty or complexity in circuitry?

Mr. GROVE. We have not reached a ceiling in capability. What we have reached is an explosion of time, in terms of time, it takes to achieve each successive step. It is still possible to do. It just, like a jigsaw puzzle, takes an enormously larger amount of time in each new step of technology. As Mr. Sevin pointed out, we are desperate-

ly trying to computerize as much of the steps as possible, but even though we have all kinds of computer aids at the beck and call of the designer, the process as a whole has not been—has not yielded to computerization. And I tend to share his view, which is a peculiar view for those of us who produce computers by the millions, this process will not be fully computerized, and therefore there's no bending of the curve, slowing down of that curve in sight.

The point I would like to make with this, is that this phenomenom of photographic copying of design, which we call chip pirating—actually, in all frankness, outside of occasions like this we call it worse, but we'll have to stick with that name for this occasion—has always been present in the industry, but it has not been either happening as frequently as it is today, nor has it been as painful. When the actual process, when we were down in the low level of the number of man-months required to produce a new product, the temptation which would put a reputable manufacturer, as you put it, into the practice of copying somebody else's design was substantially less than it is today. By the same token, the damage that he would cause to the originator of that design, was also relatively less. As this process is skyrocketing and going to the Moon, as that slide is illustrating, both the temptation is increasing, and the damage is increasing. And this is why we are coming to you and we are asking for assistance.

Just to illustrate out of my little bag, a couple—not an exclusive list—of this copying process, here is two examples that you have in the attachment. To the left is one of the most advanced products of our company. It is a 4,000-bit memory circuit that is a very, very fast memory circuit. It can work with very fast computers. It's a unique product. It is a product, in fact, that is so unique that the first time to my knowledge that IBM Corp. has ever gone on the outside to purchase full memory systems was in conjunction with our company's unique memory systems, using this component available, it was so unique. On the right, you have a photographic copy introduced within the last few months that we purchased on the open market, it's available for anyone to buy, an exact copy of that circuit by Toshiba—it's a Japanese electronic manufacturer. And not to imply that they are a commercial threat, but I have a very interesting discovery that we just ran across a few weeks ago: A photographic copying of one of our memory circuits, on the right this time—it's an old memory circuit, 5 years old—by Russians. This picture is taken—we do not have access to the chip, it comes from an article in "Aviation Week" that appeared approximately 1 month ago. So, this phenomenom knows no national boundaries, does not even know geopolitical boundaries, evidently.

That is all for the slides.

To recap the point, our industry thrives on the increasing complexity of our product. Increasing complexity means enormous design risks and design expenses. Risk, because not all of them work; you pour these millions of dollars into it and they may or may not work. The damage to us when finally the effort bears fruit and the product works, and somebody can go and with essentially a photographic camera attached to a microscope and very little sophistication and can take advantage of what we have invested, is enormous. The consequence of that damage, if not arrested, is that

nobody, no responsible management can authorize this expenditure of millions of dollars of development effort if it is known in advance that the moment it is going to work and it's going to hit the marketplace, somebody is going to take your leadership away by the act of copying. I can give a person illustration of that. This morning, this very morning, I was involved in a review meeting of a major project, a project in which the design investment is well in excess of $10 million and the major issue overhanging whether we continue with the rate of investment or not, was searching our brains as to the likelihood that we will be able to protect those designs once they hit the marketplace from exactly this type of copying. We have continued with that project today, but if this pirating and the trend in increasing pirating continues, the day will come when the aggressiveness with which we are investing in product development will stop, and that will be the beginning of the end of leadership in semiconductor technology for our industry and for our country. That is why I am asking for this committee's support.

Mr. KASTENMEIER. Mr. Borovoy, would you care to make a statement?

Mr. BOROVOY. No.

Mr. KASTENMEIER. Mr. Grove, you would concede that if protection were possible for this area to the extent that you've requested for reasons you've recited, you do concede, do you not, that 75 years is not a necessary term of protection?

Mr. GROVE. It is not a necessary term at all.

Mr. KASTENMEIER. What would be a minimum necessary term of protection?

Mr. GROVE. Ten; seven to ten.

Mr. KASTENMEIER. Seven, ten, fifteen years, to be on the safe side?

Mr. GROVE. Yes.

Mr. KASTENMEIER. That's to be on the safe side. Actually, 7 years would probably be adequate, given the fast-moving nature of the present technology?

Mr. GROVE. That is exactly the point. In this industry, things have changed fast enough that 20 years—there is probably very, very few semiconductor products or integrated circuit products today, that are being produced today, that were made even 10 years ago. It is in the first several years of the existence of the product that the protection is necessary. The producer of the product has a lead, and it is that lead that needs to be protected.

Mr. KASTENMEIER. Mr. Grove, or Mr. Sevin, what efforts have your companies made legally to protect, apparently unsuccessfully, but what alternatives have your legal departments considered in an effort to protect these designs to date?

Mr. BOROVOY. Let me take that one, if I could.

I'm Roger Borovoy, also from Intel Corp.

Obviously, most of these products that were spoken of today have one aspect or another covered by a patent. For example, the process of making it can be covered by a patent. Certain of the circuit elements which might cover a small part of it would be covered by patent. So that's one area. As has been explained, the patents are

generally cross-licensed throughout the industry, so everyone has access to everyone else's patent.

The only other area of protection was the one addressed earlier, the area of unfair competition based on the International News Service case and other cases that have followed, and that is such an undeveloped area of the law it's really a situation where a court more or less feels that the plaintiff has been harmed and the defendant did it, and therefore the court ought to award protection, but there is no rhyme or reason; sometimes cases go one way and other cases go another. So, really, obviously, the proprietary information is protected from the point of view that we don't let our process information out, but as Mr. Grove did explain, generally most of the companies in the industry have very similar kinds of processes, not exactly the same, but after a chip has been out for a year or two, maybe 6 months even, the processes have caught up to the point where the chip pirates can reproduce the same chip. So, none of the areas has been totally satisfactory, and of course, 98 percent of what's covered on one of these drawings is not protectable by patents.

Mr. KASTENMEIER. Unfair competition or any other, have you considered any other efforts to seek some sort of legal remedy through unfair trade practices or unfair competition?

Mr. BOROVOY. None that I know of, other than, of course, we did sue the Copyright Office, taking the position that present copyright laws should cover us.

Mr. SEVIN. I have something to add. We did seriously consider, we studied both of those designs and copies and seriously considered bringing suit against one or both. But our attorneys, after a thorough review of the applicable law, concluded that the law was not clear, not actually that good, and in either case we would be taking on a company about 20 times our size, and we concluded that discretion was the better part of valor.

Mr. KASTENMEIER. Do you recall under what theory you might have proceeded against them?

Mr. SEVIN. Unjust enrichment.

Mr. KASTENMEIER. If some form of statutory copyright protection was enacted, you made some reference in the patent situation and cross-licensing, would there be some—do you think there would be some similar licensing of competitors or assignment of rights that perhaps would permit the foreign corporation or some domestic corporation from using these circuitry designs?

Mr. GROVE. The answer to that is yes. Even today, even in the absence of legislation, we have gotten into agreements with certain companies from time to time where we permitted them the use of our designs, as if it was a copyrightable item, in return for certain considerations that we found equally valuable.

The problem today is that you are depending, if you wish, on the morality of the company. A company that considers that a moral approach versus photographic copying not a moral approach, will enter into that kind of a trade and another company won't. And that is a very tenuous ground to rely on when the stakes are tens of millions of dollars.

Mr. KASTENMEIER. Thank you. I'll yield now to the gentleman from California, Mr. Edwards.

Mr. EDWARDS. Thank you, Mr. Chairman. I really only have one question. We will have later this afternoon witnesses who I think are competitors of yours who are going to take a contrary position, although I have not seen their testimony. Can you anticipate what the nature of their objections to this bill will be and what would your response be to their objections to this bill?

Mr. GROVE. I would rather not anticipate the nature of their objections.

Mr. EDWARDS. Do we have any other nonanticipators? You must know that they are going to object.

Mr. GROVE. I found out when I entered the courtroom today.

Mr. EDWARDS. Pardon?

Mr. GROVE. I found out when I entered the courtroom today.

Mr. EDWARDS. Well, we only found out the day before yesterday ourselves.

Do any of the witnesses know what the objections are going to be?

Mr. BOROVOY. One thing, Mr. Edwards, I think we're all going to be here during whatever statements are made, and we would be pleased to reply afterwards.

Mr. EDWARDS. Thank you very much.

Mr. KASTENMEIER. I think that's a fair statement, Mr. Edwards. The witnesses are here. If there is a point to reply, or continued dialog on a question, I think perhaps the witnesses could then respond, or even at a later point in time, by written statement. Since we're not interested in foreclosing anybody, we hope to benefit from whatever differences there may be in connection with this matter.

The gentleman from California?

Mr. MINETA. Thank you, Mr. Chairman.

I'd first like to express my thanks to you for allowing me, a nonmember of the committee, to sit in on this hearing. Not being a lawyer, of course, I'm not on the Judiciary Committee.

I'd like to ask, where would this legislation help in terms of the illustrations you've given here of Toshiba, of the Russian copying that was done? Where does this law protect as far as being able to prevent them from copying and pirating the fruits of your R. & D. efforts?

Mr. GROVE. Let me take a layman's answer to your question; not being a lawyer either, I will turn it over to Mr. Borovoy after that.

I think the most important factor from the enactment of this legislation would be merely the simple fact that it would be against the law to copy those chips. The overwhelming majority of us in this business are law-abiding people. It is not so much the threat of the prosecution and what would happen if, that keeps us from breaking the laws; it is that there is absolutely no rationalization about the rightness or wrongness of doing something when the law says that it is wrong. I have a feeling that at least some of those copies—and I don't mean the Russian one among them—but I will venture that two of those copies that I am familiar, one of Mr. Sevin's and one of my examples, would not have taken place merely because the statute says that it's wrong. So right away some of the disreputable question—you know, the margin for error,

the margin for judgment being taken away, a billion dollar company is not going to be playing around with shady practices.

Mr. MINETA. So, it would not be criminal prosecution but a civil suit that would enable you to be involved in civil litigation against whoever is pirating those items that would be protected by this legislation once it becomes enacted?

Mr. GROVE. Rather than answering your question, let me pass that on to Mr. Borovoy also. My point is, my simple engineering approach to this is that in 90 percent of the cases that would take place today, it would not occur, and there would be no litigation, civil or criminal, merely by virtue of the fact that the law of the United States says that it is against the law.

Mr. KASTENMEIER. Would my colleague yield? I think probably Mr. Baumgarten, who is best able to answer both those questions, what sanctions there are under present copyright law or violation of copyright, that is to say, and also the international aspect of the U.S. copyright law, as far as foreign organizations are concerned. He will, I think, probably respond to that more fully than the present panel, even Mr. Borovoy, who is a lawyer, but Mr. Baumgarten is the one singular copyright expert in the room, and I think he'd give a full, definitive answer to your question.

Would you be willing to do that?

Mr. BAUMGARTEN. Certainly; do you want me to do it now?

Mr. KASTENMEIER. It's up to you.

Mr. MINETA. I'd like to hear, if I might hear the implication of this legislation.

Mr. KASTENMEIER. Thank you, Mr. Baumgarten, if you could respond to the question. The panel need not leave. I think it's just for the purpose of describing the implications of copyright coverage for foreign organizations and foreign individuals, one and two, what the sanctions are, civil and/or criminal.

Mr. BAUMGARTEN. If the duplication occurred in a foreign country, the actual photoreproduction of the chip, our law would not make that unlawful in the foreign country. It might help in one very technical respect that I won't trouble you with, but the legitimacy of the duplication would be measured by the law of the country where the duplication occurred; however, the copyright owner of the chip, the American copyright owner, would be able to prevail upon the Customs Service, for example, to erect an importation prohibition to the bringing in of the unauthorized duplicates into this country. And the U.S. copyright owner would also be given certain rights in a civil action without relying upon the Customs Service to keep them out of the country, but it would not make the act of duplication itself in the foreign country actionable. I think they're more concerned with keeping them out of the country than anything else.

Of course, if the duplication went on in this country, then the very act of duplication would be unlawful.

The second question, as to the nature of the relief, it could be criminal or it could be civil. If a company engaged in unauthorized duplication repeatedly, willfully, and for profit, I'm sure the interested copyright owners might approach the Justice Department for criminal prosecution. The direct precedence for this is sound recording piracy, where Congress passed the Sound Recording

Amendment of 1971, gave protection to the phonograph record manufacturers, but piracy was so widespread the copyright owners felt they needed more clout, and the FBI has cooperated. So, it could be civil, it could be criminal.

With respect to the international aspect, the primary benefit would be to keep them out of the country.

Does that answer your question?

Mr. MINETA. Let's say it takes a year before the discovery is made that a component piece of this is something that has been pirated. I guess damages would then be something they could bring out in court?

Mr. BAUMGARTEN. I would hazard a guess—and I'm not certain, they may correct me on this, it's their industry—that they would be more interested in the possibility of importation exclusions and injunctive relief than they would be in securing actual monetary relief. In fact, it would probably be almost—well, it would be very difficult for them to prove specific monetary damages. The statute does give them statutory damages which they could, if they could get, even if they couldn't prove actual damages, but I would suspect they would be more interested in the customs bar and the possibility of injunctive relief.

Mr. MINETA. Mr. Baumgarten, in your response you said that customs "might" prohibit the products coming in. Why would you even say "might" if it were in violation of U.S. law, and would not be absolute?

Mr. BAUMGARTEN. First of all, customs would have the authority under the new statute. The impetus to the exclusion would have to come from the copyright owner, and the copyright owner might have to record certain statements at the various ports of entry, there would have to be discovery that an unauthorized shipment was coming in, and then customs would have to be persuaded that what was coming in was in fact an infringement, but the clear authority remains in the statute, it's just a question of proof.

Mr. MINETA. Thank you very much.

Mr. KASTENMEIER. Counsel?

Mr. LEHMAN. Mr. Baumgarten, do design protection statutes which exist in other countries now, protect computer chip designs, and if so, would the United States have a statute of this nature, would that offer the possibility under reciprocal agreements of international protection?

Mr. BAUMGARTEN. Let me answer the second question first, please. I haven't studied this carefully. I think—let's talk about the Railsback bill, because that's essentially the one prospective design copyright bill we have—I'm not sure that Mr. Railsback's bill would protect without some modification because that bill does refer to ornamental design of useful articles, and I'm not sure these would be considered ornamental, even though they are not strictly functional. But it certainly could be adjusted to meet that.

The design protection laws in foreign countries, they vary greatly, and I don't purport—I can talk about their copyright laws, but I doubt if very many foreign copyright laws would be considered to cover this. But whether foreign copyright laws as opposed to design patent laws would protect it, I would prefer not to hazard a guess as to that. I suspect as is true in many cases, the technology has

really developed so much in this country that the issue hasn't arisen in the foreign countries yet.

Mr. BOROVOY. England is the only country where I think there might be protection.

Mr. LEHMAN. Then this would, though, if the United States would pass this statute, this would become then the subject of consideration, I assume, by the Burns Convention?

Mr. BAUMGARTEN. That was the technical thing I wanted to avoid. Certainly if the United States, at a practical, political level, if the United States decided clearly to make these types of devices subject to copyright, that would have tremendous impact within the very meaning, and upon members of the Universal Copyright Convention. There's also a technical aspect of that referring to the fact that, if I could say it briefly, generally the rule in international copyright is that protection in foreign countries doesn't depend upon whether it is protected in its own country, so that the Soviet Union and Japan and Britain were to protect these types of work with their copyright law, the fact that we did not wouldn't prevent them from going ahead and doing so. There's a technical exception to that which says that they don't have to protect the work longer than the term given to the class of work in its country of origin. If the term in this country were zero, then they wouldn't have to protect it for longer than zero. But there's a conceptual question about whether the word "class of works" would include this type of device. If it did, then protection of the amendment offered by Mr. Mineta and Mr. Edwards would help protecting against activities which go on abroad, that's clearly true. But I think their principle concern right now is getting the protection here for its own sake.

Mr. KASTENMEIER. Mr. Mooney?

Mr. MOONEY. Just briefly, while Mr. Baumgarten is a member of the panel, the question arises in Mr. Sevin's testimony with regard to the layout of designers and the fact that they are very creative persons and that they obviously make a tremendous contribution to the development of this particular design. The question arises, to whom should the copyright run? Is it possible in the development of what becomes a chip to single out any particular person or persons who should be entitled to the copyright?

Mr. BAUMGARTEN. Mr. Mooney, one of the questions we had, and I think it's been answered to my satisfaction, perhaps Mr. Borovoy could translate it in his general testimony into legal terms and satisfy me even further, I think it becomes clear that the effort of the layout designer in selecting which way to do things and which lines run where is something which is rather unfettered by the purpose of the chip and the designer could do it several different ways and the way he chooses to do it is something that they want to protect. And it's also my understanding that what you see on the chip, if I can speak in a layperson's terms, is the product of that layout designer's efforts, and they would wish to continue that protection from its paper form to its appearance on the chip.

As to who it should run to, I would assume that most of these designers are employees for hire, so the protection would run to the company rather than to the individual author, and does in fact run to the company today to the extent the drawings are copied.

Mr. BOROVOY. And also, there's more than one author in most instances, since these things have such huge complex tasks.

Mr. BAUMGARTEN. I guess the sum of what we're saying is it would run to the company who originated the chip, whether you start from the drawing or—the doctrine is a little different but the result is the same.

Mr. KASTENMEIER. Thank you, Mr. Baumgarten.

On behalf of the committee, I'd like to express my thanks to the three witnesses for clarifying or educating us as to the problem and the technology we've been discussing.

At this point, I would like to now invite Mr. James Angell, professor, Stanford University, Department of Physics.

We are very pleased, indeed, to welcome Professor Angell as a witness and we would be happy to hear what you have to say, sir. You may proceed.

TESTIMONY OF DR. JAMES B. ANGELL, PROFESSOR, STANFORD UNIVERSITY

Mr. ANGELL. Might I start out with sort of an anecdote that made me so happy to be able to share some thoughts with you.

It was about 11 years ago, as I was sitting in my office at Stanford, that two people who were about to found a company, which became Intel, one of them called me to ask if I had any recommendations for a person to join them who was in the field of circuit design, which happens to be my field. He explained he was a physicist and his partner was a chemist and he felt he would need a circuit designer. I had thought I might get a call like that and I said, "Yes, I have two recommendations; one is the one I hope you will follow and that is me, and the other is the one I would recommend that you follow and that is a gentleman named Ted Hoff. Ted had been a doctoral candidate at Stanford in the 1960's, late 1950's and early 1960's.

I was one of the readers on his thesis. I later became the research supporter for some of his research work and was highly impressed.

Well, he followed my recommendation and not my hope; you see I am still at Stanford. It was about 8 years later when an issue of Fortune magazine showed a picture of Ted Hoff, the father of the microprocessor holding up one of his babies. That, to some extent, makes me feel maybe I am the grandfather of the microprocessor.

I use this as a means of showing how it is that we in the university interact in one very important way to us with industry. There's probably nothing more important to a member of the university team than a success of its people. People are our principal product. We don't make profit in the university. So, I am very proud of Ted Hoff and his role in that regard. I don't really know whether to be proud or jealous of him but I will use pride because that is a more satisfying emotion.

I am also very grateful for the environment which industry, in this particular case Intel, provided to Ted Hoff which enabled him to use what I felt, and a lot of us felt, was his creativity to produce a product, to produce a concept which led to products and is leading to more products which are going to have such a profound impact on our future, the future of everybody. I would like to think

that all our students could be that successful but I am not that much of a dreamer. Yet, I do feel that the gratitude which we in the university have toward industry is not only the support we get from industry but rather the opportunities which are provided for our people to do their thing in serving the future.

Now, in the testimony which I believe you have, I mentioned some of the specific means in which industry has materially supported the university through cooperative programs, through gifts, through consulting opportunities for our faculty and in some cases, for our research staff and, of course, employment opportunities for our graduates as they finish with us.

I feel that the kinds of opportunities which Ted Hoff and other students equally creative have had can only exist if there is enough, shall I call it venture, capital to try the new in a company that has the opportunity to explore the new because they have been successful in some of their previous concepts, then people like Ted Hoff have the opportunity to develop micro processors.

I don't see that it is going to be possible for such companies to continue to have enough available profit to try the new because, as my predecessor witnesses here have explained, some of these new things to be tried get extremely expensive and it seems that if the people who developed new products in the past are going to be subject to competition from people who have not had to go through the cost and will not have to go through the cost in the future, enormously growing costs of creating these new products, it looks to me like we are going to reduce the opportunities for some of the finest creative lines and thus, reduce the future creativity of our Nation as a whole. That is, perhaps, the chief reason why I am glad to be here to share in part with you my belief, my hope that something resembling this new law which is being proposed will indeed be successful and I guess that is why I am glad to be a professor.

Mr. KASTENMEIER. Thank you, Professor. Other than here in the greater San Jose area, where else in the country and in the world is this sort of development and leadership taking place?

Mr. ANGELL. Certainly, it is more concentrated in the region between San Jose and Palo Alto, I guess, than anywhere else in the world. You heard one gentleman from Texas. There is another company in Texas which has certainly made major contributions in this field, Texas Instruments. Of course, there are companies on the east coast that have been doing a lot of development along similar lines. I suppose the largest of all is IBM.

Within the country I think you will find a lot of activity on both coasts. Now, there is also a substantial amount of integrated circuit development, large-scale integrated circuit development, micro processing development, some of it copying and some of it original, in other countries of the world. I was on sabattical leave over in Europe last fall and was very impressed by what I saw, both in some of the industrial concerns there and in the universities there. They, too, are trying, for example, in Germany and Holland. They are trying the same sort of cooperative venture.

There are, of course, many companies in Japan that are doing this. I can't speak of the degree of cooperation there between industry and universities because I have not pursued it there.

Mr. KASTENMEIER. Do you think, from a technological standpoint, we know enough about this to write a law? By that, I mean not whether we have learned enough today about it but whether future change might render anything we might enact today obsolete by virtue of further development? Is there anything, to your knowledge, that would suggest that even the terms we use, convey circuits, semiconductors and so forth, might evolve into different terms or different technology and, therefore, what we contemplate today might be, in a sense, rendered obsolete in 5, 10, 15 years to come.

Mr. ANGELL. I have always been a lousy forecaster in trying to estimate how fast this field would grow. I have always underestimated. I must say the types of technology that have been described here by the earlier witnesses are really not at all different in kind or concept from the kinds of technologies that we use in the early generations of integrated circuits back in the period, say, 1960 to 1965, same technology, same general principle, of course vastly refined and a lot more elaborate in terms of the number of transistors and components that they can put on one integrated circuit chip. It is really very similar technologies and I think that had we seen, in the early or mid 1960's, that this possibility, the importance of preserving chip patterns for their creative merit, had we foreseen in the early 1960's the need for writing the law and had written the law back then, I think it would apply today. That's about as close as I can come to forecasting the future.

Mr. KASTENMEIER. Mr. Edwards.

Mr. EDWARDS. Thank you, Mr. Chairman. I appreciate the testimony too. I guess I only have one question.

One witness is going to say that the only beneficiaries of this law would be the foreign competitors of the U.S. semiconductor industry and American consumers would suffer. How do you respond to that?

Mr. ANGELL. Well, from the standpoint that whenever a foreign competitor is able to use our technology, the technology that we have developed or the artistic designs, the creativity which we have developed, at a lower labor cost than we do, it seems to me that we are involved with exporting our own money and bringing in products that are produced by labor that eventually causes a deficit of payments. I am thinking in terms of the deficit of payment problem.

Mr. EDWARDS. Thank you, Mr. Chairman.

Mr. KASTENMEIER. Mr. Mineta.

Mr. MINETA. Mr. Chairman, I have no questions, other than to thank the doctor for his contribution. I just want to say, as a Berkeley graduate, I am being surrounded by colleagues from Stanford. I am glad to see Dr. Grove is here who is a Berkeley graduate also.

Mr. KASTENMEIER. Thank you for being here. Thank you for your contribution, Mr. Angell.

[Written text of Mr. Ansell's statement follows:]

STATEMENT OF PROFESSOR JAMES B. ANGELL

[Dr. James B. Angell is Professor and Associate Chairman of Electrical Engineering at Stanford University and Chairman of the Electrical Engineering Department's Graduate Admissions Committee. Dr. Angell has been a Professor at Stan-

ford since 1960 and has a Doctor of Science Degree from MIT in Electrical Engineering. Prior to joining Stanford, Dr. Angell worked in the Electronics Industry.]

The Edwards, Mineta, and McCloskey bill, in my opinion, is a good example of desirable legislation that encourages creativity over pirating. I have been at Stanford since 1960—the beginning of the growth of Silicon Valley. Stanford and the semiconductor industry, both here and elsewhere, have worked together in partnership to create new technology and to educate students. The profits made by this industry—one of the most rapidly growing industries in the United States—have been used to generously support universities like Stanford in training students who later on will go on to develop further new American technology.

I am not speaking only of direct gifts and research grants by industry to universities. I am including the donation of equipment, the hiring of university professors as consultants, the cooperation and support of seminars which our universities hold for the benefit of faculty, students and industry, industry participation in joint conferences, the hiring of students for summer and cooperative programs, and the many other ways that industry and academia form an active partnership.

In the Silicon Valley we have an impressive array of creative talent. The semiconductor industry, as it has evolved today, was started here by my colleague Professor William Shockley, earlier the co-inventor of the transistor at Bell Telephone Laboratories. Dr. Shockley started Shockley Laboratories in Palo Alto in the mid-1950s. From Shockley Laboratories evolved Fairchild Semiconductor in Palo Alto and Mountain View where the planar transistor and integrated circuit were invented. From Fairchild, some twenty-five companies were spawned including Intel Corporation, a well known product innovator and inventor of the microprocessor. Primarily, these companies have not achieved their success by copying each other's products. Each one took the products which existed and improved and innovated to come up with better, different and highly successful devices and technologies, often employing new concepts and advanced graduate students from Stanford's program in the process. These costly R&D efforts have enabled the Silicon Valley to mushroom to world-wide fame in semiconductor technology.

I do not see any way that the universities could be benefited by copying or chip pirating in the industry. Such activities reduce the fruits of development programs—the nourishment upon which the university system prospers. If foreign and domestic industries are permitted to freely copy each other's innovative products, the venture money provided by the free enterprise system would dry up and no longer support expensive research and development programs for the innovators. I fear that America would thus lose the momentum of its precious technological and creative leadership in integrated circuits, to the detriment of our industry, university system, and national economy. This is why I am encouraged to learn of the Edwards, Mineta and McCloskey bill.

Mr. KASTENMEIER. Next, I would like to invite forward Dr. James M. Early, Fairchild Instruments Corp. and Mr. John Finch, National Semiconductor Corp. and any others, Mr. Sheridan and Mr. Rakonitz, if you would like to come forward too.

I have the prepared testimony of Mr. Finch; however, if Mr. Finch or any of you desire to lead off.

Mr. FINCH. Mr. Chairman, my name is John Finch. I am with National Semiconductor. I would like, at this time, to introduce two other members of our corporation. At my immediate right is Mr. George Rakonitz, vice president of commercial relations and at his right is Mr. James Sheridan, our corporate patent counsel.

I do have an oral statement that I would like to give and I would like to place in the record a more detailed discussion of our views on this issue.

Mr. KASTENMEIER. Without objection, your statement, which you have already submitted, will be a part of the record. You may proceed as you wish.

TESTIMONY OF JOHN FINCH, NATIONAL SEMICONDUCTOR CORP.

Mr. FINCH. National Semiconductor is one of the largest of the U.S. semiconductor companies. We are a reknown world leader in

analog and integrated circuit design production. We probably have the largest significant patent portfolio in the analog integrated circuit area. We also have the largest number of proprietary analog products.

Greater than 50 percent of our total semiconductor sales revenues are national proprietary products, that is, a design conceived and designed by the National Semiconductor. These include products in both analog and digital types of integrated circuits. So, we feel that we have a very strong interest in this issue.

I am appearing today to oppose H. R. 1007. Adoption of this legislation can only result in a reduction in the ability of U.S. semiconductor companies to compete in world markets, and increased costs to U.S. consumers of semiconductor products. The true beneficiaries of this law would be the foreign competitors of the U.S. semiconductor industry.

It is the consumer who has benefited from the competition in the semiconductor field. There has been a dramatic and continuing decrease in prices with increased performance. The Federal Trade Commission, in its staff report on the semiconductor industry, said, and I quote:

> The most important feature of this industry is its rapid rate of innovation and technological change. The rapid rate of innovation is the result of the use of second sourcing, the mobility of technical personnel and the relatively low cost and ease of entry into the industry. Most firms hesitate to bring trade secret or patent infringement suits because of the expense involved, cross-licensing being the most common avenue. The rapid innovation and copying can also be explained by the number of times executive and technical personnel have left large firms to set up their own small, spin-off firms.

H. R. 1007, by establishing an entirely new class of product protection, threatens to remove this very important characteristic of the semiconductor industry. The copyright laws have no extra territorial effect. Therefore, only U.S. companies would be hindered by this amendment. A very significant percentage of U.S. semiconductor companies sales go to foreign markets.

Penetration of these foreign is an important long-term objective of all U.S. companies. This amendment would not prevent any foreign company from buying the chip of a U.S. manufacturer, copying it in some foreign country and selling it to the rest of the world. Only U.S. manufacturers who perform the essential and lasting interfusion steps in this country would be hindered by fear of copyright enforcement actions.

This amendment creates an entirely new class of protection for useful articles. No legal precedent exists for analyzing a scope of protection which is available under this new law. There is no way of forecasting what portion of a chip of another may be emulated without rising to the level of copyright infringement. This industry may be forced into a position where reverse engineering is unavailable and illegal. This is contrary to practice in most business areas and the only beneficiary of legislation will be our foreign competitors who fully share the developments and design.

The copyright law does not apply the standards of novelty and inobviousness which exist in the patent laws to prevent a proliferation of patents covering trivial improvements. Any new chip design can be copyrighted.

Protection for that design will last not for 17 years but for 75 to 100 years.

Proof of access by the designer of an accused chip to the copyrighted chip, plus substantial similarity of portions of the two chips, would make out a prima facie case of copyright infringement. Thereafter, the accused party bears the burden of proving that his own chip was independently developed or that there was nothing new in the copyrighted chip. And in an industry requiring identity of form, fit and function between the original article and the second sourced article, such proof may simply not be possible.

The obvious potential result is exclusivity for a copyrighted design beyond the dreams of any patentee.

The remedies of the copyright law are not appropriate to the protection of useful, industrial mass-produced items.

The amendment of the copyright laws would create an entirely new class of remedies for copying of industrial products, including:

First, statutory damages, or the award of actual damages and profits;

Second, award of attorney fees at the court's discretion;

Third, criminal sanctions and penalties for willful infringement; and

Fourth, the destruction of copies and the equipment used to make such copies.

These sanctions have no parallel in the patents laws, the traditional and proper form of protection for useful products such as integrated circuit chips.

Mr. KASTENMEIER. Thank you, Mr. Finch. Does that complete your statement?

Mr. FINCH. That completes my statement. Thank you.

[The document referred to follows:]

STATEMENT ON BEHALF OF NATIONAL SEMICONDUCTOR CORP.

Mr. Chairman; I am appearing today to oppose H.R. 1007. Adoption of this legislation can only result in a reduction in the ability of U.S. semiconductor companies to compete in world markets, and increased costs to U.S. consumers of semiconductor products. The only beneficiaries of this law would be the foreign competitors of the U.S. semiconductor industry.

It is the consumer who has benefited from the competition in the semiconductor field. It is the consumer which the Federal Trade Commission had in mind when, in its staff report on the semiconductor industry, prepared by the Bureau of Economics, January 1977, it noted:

> "The most important feature of this industry is its rapid rate of innovation and technological change. Although it has a high rate of expenditures on research and development, those expenditures can only partly explain the rapid rate of innovation. Other features that seem equally or more important are the use of second sourcing, the mobility of technical personnel, and the relatively low cost and ease of entry into the industry. The fact that companies can rapidly copy each other is very important. This rapid copying is the result of the mobility of personnel from firm to firm and the unwillingness of most firms to bring trade secret or patent infringement suits. The rapid innovation and copying can also be explained by the number of times executive and technical personnel have left large firms to set up their own small, spin-off firms."

H.R. 1007 threatens to remove this very important characteristic of the semiconductor industry.

1. This amendment would work a basic change in the law, resulting for the first time in the protection of useful articles. Such a change was considered and rejected in the recent revision of the Copyright laws.

A "useful article," the protectable "design" of which excludes its purely utilitarian aspects, is defined in Section 101 as:

". . . 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.' "

Section 113(b) of the statute makes clear that the rights which may attach to this matter are nonetheless restricted essentially to those rights, no more and no less, which attached under the 1909 Copyright Act. Section 113(b) states:

113. Scope of exclusive rights in pictorial, graphic and sculptural works (a) * * *

(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."

The process of deriving the three-dimensional multi-layered chip from the series of two-dimensional circuit designs is analogous to the construction of a machine from a blueprint, or a building from a set of architectural plans. It has traditionally been held that the copyright in a scientific diagram, blueprint or set of architectural plans provides protection against only the copying from the proprietor's plans to produce another set of plans.

The copyright in such instance does not convey any exclusive right to construct the machine or the building described in the plans nor any exclusive right to prevent the copying of the machine or building once the construction has taken place and control has been relinquished over the completed machine or building.

This principle has been enunciated in a number of cases, all relying on *Baker* v. *Selden; Imperial Homes Corp.* v. *Lamont,* 458 F. 2d 895 (5th Cir. 1972) (floor plans protectable against copying, but defendant not "in anywise restricted . . . from reproducing a substantially identical residential dwelling"); *Scholz Homes, Inc.* v. *Maddox,* 379 F. 2d 84 (6th Cir. 1967) (promotional booklet depicting architectural plans for home not infringed by construction of similar home); *De Silva Constr. Corp.* v. *Herrald,* 213 F. Supp. 184 (M.D. Fla. 1962) (architectural plans not infringed by constructing building from the plans). The analogy here is that the copyright on the utilitarian diagram or drawing, which is represented by each of the masks used to produce the chip, does not carry with it any exclusive right to prevent others from creating directly or indirectly *from that chip* the same "complex . . . topography" and "intricate three-dimensional architecture" (Oldham, W.G., The Fabrication of Microelectronic Circuits," 237 *Scientific American* 111, 113 [Sept. 1977]) as that produced by the proprietor of the original masks.

2. The legislative history of the Copyright Law of 1977 makes it clear that the question of protection for useful articles was considered and rejected.

The legislative history pertaining to pictorial, graphic, and sculptural works sharpens the focus of both the definition in Section 101 and the restriction of rights by reason of Section 113(b):

"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.* . . . Purely non-functional or monumental structures would be subject to full copyright protection under the bill. . . . 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." (H. Rept. 94-1476 (accompanying S. 22, 94th Cong.), Sept. 3, 1975, p. 55)

3. There is no more reason to protect the product of the masks used in integrated circuit design than the end product produced by any numerically controlled machine tool.

Integrated circuit chips are manufactured by a photoengraving process; but first the layout must be designed and appropriate masks must be prepared. The structure and design of an integrated circuit chip is so complicated that typically a substantial part of the design is executed not by a human being *but by a computer.* Once the functional characteristics of the device and the necessary manufacturing steps are specified, the next step is to use a computer to aid in estimating the size and approximate locations (in three dimensions) of each circuit component. To determine optimal component combinations and configurations, the computer simulates the operation of the device with various changes until a desired end result is achieved. The computer also "draws" the layout of the chip. The goal is to achieve the desired function of the circuitry in the smallest possible space by a trial-and-error process. At the end of the process, the computer memory contains a list of the

exact positions (in three-dimensional space) of every component in the chip. The computer then generates the series of masks needed to manufacture the chip.

The computer produces the masks as follows: First, it directs a light spot across a photographic plate (called the "reticle"), using the information stored in the computer to generate on the reticle an enlarged version of the desired pattern for the particular layer of the chip, in much the same way that a TV set can use a TV signal to produce a picture on a TV screen. The result is an enlarged reproduction of what will ultimately be the portion of one mask corresponding to a single layer of one chip. Commonly at this point an enlarged reproduction of each of the reticles for the various layers is made, printed on Mylar or another transparent plastic. These are then placed over one another in a stack corresponding to the layers of the sandwich making up the chip. The designers can then check the overlays to make sure that the successive layers properly match up with one another, so that parts of one layer that are supposed to touch particular parts of the next layer indeed do so. If there is no error, the reticle is ready for use in the next step.

An optical image of the reticle, greatly reduced in size, is then projected on the surface of the mask. The process is repeated for each layer of the sandwich that makes up the particular chip; usually this is done in the step-and-repeat process all at one time for the different masks for the respective chip layers.

The masks are then used to produce a large number of expendable mask replicas called "working plates." The working plate replicas of the masks are then used to make the chips.

Thus, a mask is basically a computer-implemented design, once the essential parameters have been laid down by human engineers.

Copyright protection exists for the programs; and patent protection is available both for the processes employed and the novel and unobvious end products thereof. This is true of any industry using computer aided or implemented designs. There is no reason for this special legislation creating a unique class of statutory protection for the useful end products of this single industry.

4. The Copyright Laws have no extra territorial effect; therefore only U.S. companies would be hindered by this amendment.

Penetration of foreign markets is an important long-term objective of all U.S. companies. This amendment would not prevent any foreign company from buying the chip of a U.S. manufacturer, copying it in some foreign country and selling it to the rest of the world.

Only U.S. manufacturers, who perform the essential masking and diffusion (i.e. printing) steps in this country would be hindered by the fear of copyright enforcement actions.

5. Because the copyright laws have never before protected useful articles per se, an entire industry must stop to grapple with the issue of what constitutes "fair use" of utilitarian chip designs. No case law exists for guidance on this subject.

This industry has achieved its rapid growth in part because of the second sourcing accepted within the industry. This new law will eliminate, or cause great hesitancy in even partial use of the designs of others, even though such designs *do not merit patent protection.*

There is no way of forecasting what portion of a chip of another may be used without rising to the level of copyright infringement. This industry may be forced back to a position where every company must "reinvent the wheel". The result will be a loss of momentum and indeed general stagnation of the industry at a critical time in its growth. The only beneficiary of the legislation will be our foreign competitors who fully share their developments and designs.

6. The copyright law does not apply the standards of novelty and inobviousness which exist in the patent laws to prevent a proliferation of patents covering trivial improvements. Any "new" chip design can be copyrighted.

Protection for that design will last for not 17 but 75–100 years.

Proof of access by the designer of an accused chip to the copyrighted chip, plus substantial similarity of portions of the two chips, would make out a prima facie case of copyright infringement. Thereafter, the accused party bears the burden of proving that his own chip was "independently developed", or that there was nothing new in the copyrighted chip. And in an industry requiring identity of "form, fit and function" between the original article and the second sourced article, such proof may simply not be possible.

The obvious potential result is exclusivity for a copyrighted design beyond the dreams of any patentee.

7. The remedies of the copyright law are not appropriate to the protection of useful, industrial mass-produced items.

The patent laws provided for the assessment of a reasonable royalty plus, (34 USC 284), an injunction against future infringement (35 USC 283) and in exceptional cases, attorney fees. (35 USC 285).

The amendment of the copyright laws would create an entirely new class of remedies for copying of industrial products, including:

(a) Statutory damages, or the award of actual damages and profits.

(b) Award of attorney fees at the court's discretion.

(c) Criminal sanctions and penalties for willful infringement.

(d) The destruction of copies and the equipment used to make such copies.

These sanctions have no parallel in the patents laws, the traditional and proper form of protection for useful products such as IC chips. The only result of this new array of stringent penalties, which no one in the industry has dealt with, can be a reduced rate of information exchange within the U.S. semiconductor industry, to the detriment of the entire industry and the host of users of semiconductor products. The only beneficiaries of this law would be foreign competitors of the U.S. semiconductor industry.

JOHN FINCH,
Vice President, General Manager,
Semiconductor Product.

Mr. KASTENMEIER. Mr. Early or Mr. MacPherson.

Mr. EARLY. My name is James M. Early and I am director of research and development for Fairchild Camera & Instrument Corp. and I represent that company here today. My associate, Alan MacPherson, is patent counsel for Fairchild. We will supply, by mail, a copy of the testimony here today, with such additions of detail which would seem appropriate.

Mr. KASTENMEIER. That will be fine. Please proceed with your statement.

TESTIMONY OF JAMES M. EARLY, DIRECTOR, FAIRCHILD CAMERA & INSTRUMENT CORP.

Mr. EARLY. Fairchild has been in the semiconductor business since 1957. In the late 1960's, Fairchild employees invented and developed the plane-R process, the basic process used in the manufacture of integrated circuits today.

Dr. Noyce, later one of the founders of Intel Corp. invented the integrated circuit while at Fairchild. Dr. Grove, who has spoken before this committee this afternoon, did basic work on oxide surface states at Fairchild.

Fairchild has long been acknowledged as the innovator of numerous processes and structures now commonly used in the semiconductor industry and today manufactures a full spectrum of semiconductor products ranging from diodes to the most complex integrated circuits and microprocessors.

To put my testimony in perspective, I would like to briefly relate the history of the semiconductor industry in Silicon Valley as seen from Fairchild's viewpoint.

Over the years, Fairchild employees have time and again left Fairchild to either form new companies for the purpose of manufacturing semiconductor devices or joined already established semiconductor companies in key positions. Among the companies that have either been started by former Fairchild employees or materially assisted by such employees are National Semiconductor, Intel, Advanced Micro Devices and AMI. We have with us a geneaology of these companies which Mr. MacPherson will hand to you, not prepared by us but a commonly circulated document in the industry.

Along a time base there you can see the degree to which this industry has sprung from its origins at Fairchild. I mention this only so that the following comments can be understood as being those of a party which historically has been the supplier of technical experience, training and technology to the industry here in Silicon Valley rather than the recipient of such assistance from its competitors.

The proposed bill comprises a major departure from the current concept of copyright protection as something subsisting in original works of authorship. It appears to us to directly conflict with the express statement of section 102(b) of the 1976 Copyright Act 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 or embodied in such work.

Now, photographic masks are often formed by replicating standard patterns under the control of a programed computer so as to provide desired masking layouts. A set of masks is thus not so much a work of authorship as the product of engineering knowledge. Often skillful, and sometimes creative, focused on obtaining a desired function or output. Accordingly, the patterns on the mask and the appearance of the resulting integrated circuit represent the function desired in the circuit rather than an effort of the type exerted by authors. In this sense, the proposed amendment goes beyond the standard scope of copyright protection and is in conflict with the doctrine of *Baker* v. *Selden,* 101 U.S. 99 (1879) by granting copyright protection to objects whose appearance is dictated solely by their intended function.

Baker v. *Selden* held that a copyright protects the form of expression but not the ideas. That brings us to the crux of the problem with this proposed amendment. In an integrated circuit, the form of expression is often the idea to be protected. When this is the case, numerous courts have held that the public can make use of the form of expression without infringing any copyright. Since this bill would give copyright protection to useful articles whose form is the idea being expressed, it will sharply deviate from historical practice and change the fundamental nature of copyright protection but our objection to this particular bill goes beyond this.

The Honorable Mr. Edwards stated in the Congressional Record on Thursday, October 12, 1978, that patent protection is not enough to protect the designers of complicated integrated circuits from chip pirates. According to Mr. Edwards, patents usually cover narrow circuitry aspects of the chip. Fairchild believes this is an unduly narrow view of patents. Patents can and do cover the architecture of a complicated chip and the system formed on a chip.

Fairchild believes that continued utilization of the patent system to protect the novel features of integrated circuits is a preferred alternative to this bill. For all its defects, the patent system protects an inventor for 17 years and protects the public by preventing unwarranted monopolies from attaching to obvious or nonnovel inventions.

Importantly, chip layout is the form of patentable subject matter. Whether or not a patent can issue on a chip layout will depend on

whether the layout is novel and not obvious. Novelty, on the other hand, is not a prerequisite for copyright protection.

This bill will also change the longstanding practice that mechanical devices which do not qualify as pictorial, graphic or sculptural works are not writings and may not be protected by copyright. While a photograph of such a device presently qualifies for copyright protection, the protection merely prevents copying of the photograph and not of the device.

In understanding the impact of this bill, this committee should understand the procedure that is used in manufacturing an integrated circuit, and here I will duplicate a little bit of what you heard earlier. Basically, the integrated circuit reflects the result of a complicated process involving the difusion of impurities into a semiconductor material, typically silicon, through selected regions defined by masks.

In addition, one or more layers of electrically conducting material are formed on the surface of the semiconductor chip to interconnect the various transistors, and diodes and passive components such as resistors and capacitors, all of which are formed within the chip. When a competitor brings out a new product, companies in the business buy the product, electrically test the product and usually pull the package apart to look at the chip. The chip is studied under a microscope to determine whether or not any new engineering procedures are incorporated in the chip. Photographs are taken of portions of the chip. These photographs are blown up and dimensions are obtained from the photographs in an attempt to characterize the structure of the chip. If the structure appears unique, then this unique structure might be incorporated by a competitor in its chip. Alternatively, this unique structure might be further improved by the competitor and incorporated in a new product.

If this bill were to pass, it is not clear what affect it would have on such historically practiced reverse engineering. Would the individual who carried out this activity now be liable for damages and a criminal penalty? If the copyright owner lost business as a result of the competitive product incorporating certain features of the copyrighted chip, would the copier be protected by the Fair Use Doctrine? We think the answer is possibly negative, particularly if the copyright owner can show either real or probable economical harm as a result of sales of the competitive product.

In discussions of acceptable limits of fair use prior to passage of the Copyright Act of 1976, fair use was limited so as not to have an economic impact on the copyright owner. In the semiconductor industry, the ultimate purpose of reverse engineering is to place the product on the market place so as to have the maximum possible economic impact on all competitors, including the copyright owner. Thus, we think the owner of a copyright on an integrated circuit would have a strong argument to prevent copying of even a portion of the chip should this bill pass.

An irony associated with this bill is it would give copyright protection for 75 years or for the lifetime of the last to survive of the authors, whoever they might be, plus 50 years to a structure which most likely would not be entitled to patent protection. Yet the standard for patentability, non-obviousness, novelty and utility

would not have to be met, while the protection achieved would be much stronger than that obtained through patents.

Patents have a life of 17 years from date of issuance and are granted only after examination for novelty and nonobviousness and in some cases, utility. There would be no such examination for the copyrighted material. Thus, material not entitled to patent protection could and would receive much stronger copyright protection under this bill than patentable material. The result can only be a weakening of the patent system.

The remedies for patent infringement comprise potential enjoining of manufacture. Use or sale of the infringing article, plus damages which in some instances can comprise treble damages in the discretion of the court.

However, the remedies for copyright infringements are much more draconian, comprising a fine of not more than $10,000 or imprisonment for not more than 1 year or both.

This bill, theoretically, is beamed at Japanese copying of American chips. However, American copyright law does not extend to Japan and the Japanese will be free to continue to copy American chips whether or not this bill is passed. All this bill will do is prevent the sale of copied chips in the United States. Passage of this bill might result in retaliatory action by the Japanese against American products exported into Japan.

Even if this bill were passed, it is not clear that any meaningful protection would be extended to an integrated circuit chip. Section 102(b) above, quoted above, states explicitly that in no case does copyright protection for an original work of authorship extend to any idea, procedure, process, method of operation, concept, principle or discovery regardless of the form in which it is described, explained, illustrated or embodied in such work. A semiconductor chip certainly comprises an idea, a system and a method of operation.

Furthermore, section 113 of the act provides that the act does not afford to the owner of a copyright in a work that portrays the useful object as such, any greater or lesser rights with respect to the making, distribution or display of the useful article so portrayed, no rights other 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 the court in an action brought under this title.

A useful article is defined in section 101 of the act as 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. A packaged integrated circuit is thus a useful article under this definition. The chip contained within that integrated circuit is likewise a useful article by this definition.

Accordingly, the combination of sections 101, 102(b) and 113(b) would seem to me, even if this bill were passed an integrated circuit would still be interpreted in accordance with the rule of *Baker* v. *Selden* and one could copy with impunity such a circuit.

In summary, Fairchild believes this proposed bill is neither wise nor warranted at this time and possible would not have the affect claimed if passed. Moreover, this bill raises fundamental question

as to the proper scope of copyright protection that should be resolved through extensive analysis and discussion prior to the passage of any bill.

For the above reasons, Fairchild recommends the bill not be passed at this time. We believe that further study must be made on the need for this bill and the possible effects of this bill on current standards of copyright protection and on patent protection. Clearly, the study must determine whether the potential mischief created by the bill outweighs its potential benefits.

Thank you for the opportunity to speak on this issue.

[Written text of Mr. Early's statement:]

STATEMENT BY FAIRCHILD CAMERA & INSTRUMENT CORP. ON H.R. 1007 TO AMEND THE 1976 COPYRIGHT REVISION LAW TO PROVIDE COPYRIGHT PROTECTION TO "THE PHOTOGRAPHIC MASKS USED TO IMPRINT PATTERNS ON INTEGRATED CIRCUIT CHIPS AND INCLUDE THE IMPRINTED PATTERNS THEMSELVES"

HONORABLE REPRESENTATIVES AND MEMBERS OF THE STAFF: My name is Dr. James M. Early, I am Division Vice President, and I represent Fairchild Camera and Instrument Corporation of Mountain View, California. Fairchild has been in the semiconductor business since 1957. In the late 1950's Fairchild employees invented and developed the planar process, the basic process used today in the manufacture of integrated circuits. Dr. Noyce, a founder of Intel, while at Fairchild invented the integrated circuit. Dr. Grove, who has spoken before this Committee this afternoon, did basic work on oxide surface states while at Fairchild. Fairchild has long been acknowledged as the innovator of numerous processes and structures now commonly used in the semiconductor industry and today manufactures a full spectrum of semiconductor products ranging from diodes to the most complicated integrated circuits and microprocessors. Today, Fairchild is the acknowledged industry leader in the manufacture of high-density bipolar memories and charge coupled devices. Fairchild is also the acknowledged industry leader in the manufacture of injection logic devices, and of subnanosecond emitter coupled logic devices, the circuits used in the most sophisticated and highest speed computers manufactured today. The memories manufactured by Fairchild, are faster and more dense than those manufactured by any other company in the world.

To place my testimony in perspective, I would like to briefly relate the history of the semiconductor industry in silicon valley as seen from Fairchild's perspective. Over the years, Fairchild employees have time and again left Fairchild and either formed new companies for the purpose of manufacturing semiconductor devices or joined already established semiconductor companies in key positions. Among the companies which have either been started by former Fairchild employees or materially assisted by such employees are National Semiconductor, Intel, Advanced Micro Devices, and AMI. A genealogy of the semiconductor companies in silicon valley would show that approximately 35 companies have been formed by, or materially assisted by, ex-Fairchild employees. I mention this only so that the following comments will be understood as being those of a party which historically has been the supplier of technical experience, training and technology to the valley rather than the recipient of such assistance.

The proposed bill provides that pictorial, graphic, and sculptural works shall 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 amendment comprises a major departure from the current concept of copyright protection as something subsisting in "original works of authorship" and appears to us to directly conflict with the express statement of Section 102(b) of the 1976 Copyright Act 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, or embodied in such work."

Photographic masks are often formed by replicating standard patterns under the control of a programmed computer so as to provide desired masking layouts. A set of masks is thus not so much a work of authorship as the product of engineering knowledge (often skillful and sometimes creative) focused on obtaining a desired function or output. Accordingly, the patterns on the masks and the appearance of the resulting integrated circuit represent the function desired in the circuit rather than an effort of the type exerted by authors.

In this sense, this proposed amendment goes beyond the standard scope of copyright protection and is in conflict with the doctrine of *Baker* v. *Selden,* 101 U.S. 99 (1879), by granting copyright protection to objects whose appearance is dictated solely by their intended function. In *Baker* v. *Selden,* the United States Supreme Court, in denying copyright protection to accounting forms described in a book, stated:

> Where the art it teaches cannot be used without employing the methods and diagrams used to illustrate the book, or such as are similar to them, such methods and diagrams are to be considered as necessary incidents to the art, and given therewith to the public."

Baker v. *Selden* must be interpreted in light of the long-established rule that a copyright protects the form of expression but not the ideas. And that brings us to the crux of the problem with this proposed amendment. In an integrated circuit the *form of expression is the idea to be protected.* And when this is the case, numerous courts have held that the public can make use of the form of expression without infringing any copyright. Professor Nimmer explains this doctrine as follows:

> Where the use of the 'art,' *i.e.,* the idea, which a copyrighted work explains (or embodies) necessarily requires a copying of the work itself, then such copying will not constitute an infringement of copyright." *Nimmer on Copyright, Section 2.18*[*B*].

While Professor Nimmer has criticized many applications of this doctrine, even Professor Nimmer apparently concedes this doctrine to be proper when the idea can only be used by using the copyright owner's expression. Many courts have held that where an idea can be expressed in only limited ways, then one can use the copyright owners form of expression. See for example, *Freedman* v. *Grolier Enterprises, Inc.,* 179 U.S.P.Q. 476 (S.D.N.Y. 1973) and *Herbert Rosenthal Jewelry Corp.* v. *Kalpakian,* 446 F.2d 738 (9th Cir. 1971). See also *Crume* v. *Pacific Mutual Insurance Co.,* 140 F.2d 198 (7th Cir. 1944) and *Morrissey* v. *Procter & Gamble Co.,* 379 F.2d 675 (1st Cir. 1967).

Since this bill would give copyright protection to useful articles whose form is the idea being expressed, it will sharply deviate from historical practice and change the fundamental nature of copyright protection.

But our objection to this particular bill goes beyond this.

The Honorable Mr. Edwards stated in the Congressional Record on Thursday, October 12, 1978 that patent protection is not enough to protect the designers of complicated integrated circuits from chip pirates. According to Mr. Edwards, patents usually cover narrow circuitry aspects of the chip. Fairchild believes this an unduly narrow view of patents. Patents can and do cover the architecture of a complicated chip and the system formed on the chip. Fairchild believes that continued utilization of the patent system to protect the novel features of integrated circuits is a preferred alternative to this bill. For all its defects, the patent system protects an inventor for seventeen years and protects the public by preventing unwarranted monopolies from attaching to obvious or non-novel inventions.

Importantly, chip layout is a form of patentable subject matter.[1] Whether or not a patent can issue on a chip layout will depend on whether the layout is novel and nonobvious. Novelty, on the other hand, is not a prerequisite for copyright protection.

This bill will also change the long-standing practice that mechanical devices which do not qualify as pictorial, graphic, or sculptural works are not writings and may not be protected by copyright. While a photograph of such a device presently qualifies for copyright protection, the protection merely prevents copying of the photograph and not of the device. *Nimmer on Copyright, Section 2.18*[*F*].

In understanding the impact of this bill, this Committee should understand the procedure that is used in manufacturing an integrated circuit. Basically the integrated circuit reflects the result of a complicated process involving the diffusion of impurities into a semiconductor material (typically silicon) through selected regions defined by masks. In addition, one or more layers of electrically conducting material are formed on the surface of the semiconductor chip to interconnect the various transistors and diodes and passive components such as resistors and capacitors, which are formed within the chip. When a competitor brings out a new product, companies in the business buy the product, electrically test the product and usually pull the package apart to look at the chip. The chip is studied under a microscope to determine whether or not any new engineering features are incorporated in the

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[1] 35 U.S.C. Section 101 states that "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, . . ." A chip layout is a machine or manufacture and thus patentable subject matter.

chip. Photographs are taken of portions of the chip. These photographs are blown up and dimensions are obtained from the photographs in an attempt to characterize the structure of the chip. If the structure appears unique, then this unique structure might be incorporated by a competitor in its chip. Alternatively this unique structure might be further improved by the competitor and incorporated in a new product.

If this bill were to pass it is not clear what effect it would have on such historically-practiced reverse engineering. Would the individual who carried out this activity now be liable for damages and a criminal penalty? If the copyright owner lost business as a result of a competitive product incorporating certain features of the copyrighted chip would the copier be protected by the fair use doctrine? We think the answer is possibly negative, particularly if the copyright owner can show either real or probable economic harm as a result of sales of the competitive product. In discussions of acceptable limits of fair use prior to passage of the Copyright Act of 1976, fair use was limited so as not to have an economic impact on the copyright owner. In the semiconductor industry, the ultimate purpose of reverse engineering is to place a product on the marketplace, so as to have the maximum possible economic impact on all competitors including the copyright owner. Thus we think the owner of a copyright on an integrated circuit chip would have a strong argument to prevent copying of even a portion of the chip should this bill pass.

An irony associated with this bill is that it would give copyright protection for seventy-five years or for the lifetime of the last to survive of the authors (whoever they might be) plus 50 years to a structure which most likely would not be entitled to patent protection. Yet the standards for patentability (non-obviousness, novelty and utility) would not have to be met while the protection achieved would be much stronger than that obtained through patents. Patents have a life of 17 years from date of issuance and are granted only after examination for novelty and non-obviousness and in some cases utility. There would be no such examination for the copyrighted material. Thus material not entitled to patent protection could and would receive much stronger copyright protection under this bill than patentable material. The result can only be a weakening of the patent system.

The remedies for patent infringement comprise potential enjoining of manufacture, use or sale of the infringing article plus damages which in some instances can comprise treble damages in the discretion of the court. However the remedies for copyright infringement are much more Draconian, comprising a fine of not more than $10,000 or imprisonment for not more than one year or both.

This bill theoretically is aimed at Japanese copying of American chips. However, American copyright law does not extend to Japan and the Japanese will be free to continue to copy American chips whether or not this bill is passed. All this bill will do is prevent the sale of copied chips in the United States. Passage of this bill might result in retaliatory action by the Japanese against American products exported in to Japan.

Even if this bill were passed, it is not clear that any meaningful protection would be extended to an integrated circuit chip. Section 102[B] quoted above states explicitly 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, or embodied in such work. A semiconductor chip comprises certainly a system and a method of operation. This Section 102[b] would, on its face, appear to deny to integrated circuits the very protection sought by this bill.

Furthermore, Section 113 of the Act provides that the Act 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 other 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.

A useful article is defined in Section 101 of the Act as "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'."

A packaged integrated circuit is thus a "useful article" under this definition. The chip contained within that integrated circuit is likewise a "useful article". Accordingly, the combination of Sections 101 and 113[B] would seem to mean that even if this bill were passed, an integrated circuit would still be interpreted in accordance with the rule of *Baker* v. *Selden* and one could copy with impunity such a circuit.

Patent cross-licenses are currently broadly used within the semiconductor industry. Most patent cross-licenses do not include copyright licenses. Should Congress pass the proposed bill, then these patent cross-licenses will be materially affected to

the extent that they grant prospective rights under future products. By granting a copyright on a product otherwise licensed under a patent cross-license, the licensee would no longer be free to copy all or a portion of its licensor's future products and still be within the grant of its license.

Finally, the need for this bill has not been adequately demonstrated in Fairchild's opinion.

In summary, Fairchild believes this proposed bill is neither wise nor warranted at this time and possibly will not have the effect claimed if passed. Moreover, this bill raises a fundamental question as to the proper scope of copyright protection and of the relationship between copyrights and patents which should be resolved through extensive discussion, analysis and study prior to the passage of any bill. Further study must also be made of the need for this bill and alternative ways of satisfying any need that may be found. Clearly, any study must determine whether the potential mischief created by this bill outweighs its potential benefits.

For the above reasons Fairchild recommends that this bill not be passed at this time.

Thank you for this opportunity to speak to this issue before this Honorable Committee.

Mr. KASTENMEIER. Thank you, Mr. Early, for a very well-thought out statement. Are there other members of the panel that care to be heard?

I will say that the committee did not know of your interest, or that there was a substantial division within the industry on the question, until the last couple of days. The committee is certainly interested in learning everyone's views, certainly including yours. I regret that we did not know of your interest. Were you not aware that these hearings were about to take place? You were aware, of course, that the bill had been introduced. Mr. Edwards' statement of last October was quoted. I am just wondering whether this was a position just very recently taken by Fairchild and by semiconductor companies or whether this has been a position that corporations have held for some time.

Mr. MACPHERSON. I can speak only for Fairchild. We heard of this bill being proposed, I would say, 3 or 4 weeks ago. We heard, also, that there was a committee hearing planned in California for some time in the future. I was on vacation last week when I learned that the meeting actually had been set for April 16, for today. That was the first that I had heard of it. We do have a Washington associate who may have had some information prior to that time but it hadn't reached me as of last week.

Mr. SHERIDAN. Mr. Chairman, I was first informed of this bill and National's opposition to it about 6 weeks ago when I accepted the position as patent counsel. At the time that I joined the company, which was 2 weeks ago, I would say maybe 10 days ago I received word of these hearings. We prepared a position at that time. The first we were able to coordinate everyone because of the Easter week and the lag was just at the end of last week. That is why we didn't get in touch with you sooner.

I would like to say that I was in touch with General Instrument Corp. which has its major offices in New York and also branches here. They asked me to state for the record that they also were opposed to the bill and would hope that further hearings would be held in the East or the record be held open for their comments.

Mr. KASTENMEIER. Thank you, Mr. Sheridan, for that additional explanation. While the legislation is not new, certainly in an industry where great change takes place in a very short period of time, nonetheless, I can understand that not all the companies had really taken a position with respect to it.

I would ask, Dr. Early, if you would prepare a very lucid statement and a number of copies so the committee would have then individually. Eventually, of course, these hearings will be printed but until that time my colleagues would not be able to have the benefit of your comments but would have the benefit of other comments that are in print before us.

Mr. EARLY. We plan to have that to you this week.

Mr. KASTENMEIER. Fine.

What are the differences, if I may ask, between Mostek and Intel on the one hand, and Fairchild Semiconductor Corp. and General Instruments Corp.

Mr. FINCH. National Semiconductor.

Mr. KASTENMEIER. General Instruments was the one you mentioned. On the other hand, why do their industrial interests coincide, not coincide in this connection, is it a matter of just individual interpretation of economic effect which reasonable men may differ concerning or is it the fact that you have different economic interests which distinguish you one from the other?

Mr. EARLY. I couldn't pretend to speak for the economic interests of our competitors and the basis on which they reached their judgments of the proposed legislation. This is a difficult and complex matter with many ramifications beyond its immediate obvious superficial effect. Our concerns, I think, are directed to those.

Mr. KASTENMEIER. Does someone else care to comment?

Mr. FINCH. Obviously, all people have self interest. We have looked at the bill, the proposed bill, and we see potential flaws that could cause extensive litigation, expensive costs and also could produce the competitive nature of the business. We feel that's not in the best interest of National Semiconductor or the industry.

Mr. KASTENMEIER. It may be unfair of me to ask that question but what I am trying to determine is why is it two corporations feel very strongly about the bill affirmatively and two or more negatively? Is it really a difference? You must be sufficiently familiar with Intel and Mostek, certainly to device a chart like this, to understand what they are about and so my question is really what distinguishes you other than just perspective? Is there some sort of general interpretation on the affect on the industry as a whole? Is there any differences between the corporations or types of corporations that would suggest a desire for legislation by some corporations and opposition by other types of corporations within the same industry? Are there any distinguishing features between you?

Mr. FINCH. I can explain a few differences between the two companies.

Mr. KASTENMEIER. Which would explain the differences?

Mr. FINCH. I am not sure they would. Intel and Mostek are companies that work almost entirely in MOS technology and work in memory and micro processing areas primarily. National Semiconductor and Fairchild Camera are two companies that have a very broad product line, both digital, linear. We have offerings in the memory and micro processing areas, as well as a lot of other areas. I don't pretend to understand the differences. We speak for National. We have looked at the proposed bill and we just don't think it would be good for the industry or National. Those are the

differences between the companies that come immediately to my mind.

Mr. KASTENMEIER. Dr. Early, would you agree that Fairchild is more diversified than some of these other companies?

Mr. EARLY. That is certainly true. Whether it is relevant to the matter, I don't know.

Mr. MACPHERSON. There may be one other point of importance and that is Intel and Mostek may look at the problem of copying as being a more serious problem from their business point of view than a company such as Fairchild does. Basically, when one attempts to copy mask sets, the problem is not quite as simple as merely copying a set of masks and putting the copied product into production using those masks. Rather, one has to have a process compatible with the design rules used in a mask and, so, our perception of the problem may be that the natural burdens in trying to adapt a similar process to use such a mask is in itself a barrier to the problem.

Mr. KASTENMEIER. It was clear that the problem as described to us was quite different, that is to say what Mr. Finch had to say about it as opposed to what Mr. Seven's had to say about it as to the process of reverse technology of taking pieces. The model they used was the entire code, the whole 2147 design was presumably copied, which to them possibly represented a multiple dollar investment. That, to them, may be a much more important factor than piecemeal disassembly of a semiconductor for the purpose of analysis and reverse engineering. I would say, I guess, they do see the difficulty.

Let me ask you whether you differ at all with the explanation or with what the register of copyright is presently doing in terms of accepting or rejecting patterns or chips as described by Mr. Baumgarten earlier. You heard him describe what the present practice, what the procedures, the decisions the copyright office has made at this point to this question. Do you agree or disagree with the copyright office?

Mr. MACPHERSON. I think that Mr. Baumgarten also stated that the mere acceptance of the materials by the copyright office did not mean that the person who submitted the materials had an enforceable copyright.

Mr. KASTENMEIER. He did say that, yes.

Mr. MACPHERSON. The alternative, I believe, he also stated to be the case and we think this is an act carried out by the copyright office, certainly, within their discretion for which to do that. We feel that ultimately the courts or Congress will have to determine exactly what the law is in this matter.

Mr. KASTENMEIER. Your opposition to H.R. 1007 appears to be, at the moment, unequivocable. You do not suggest any other alternatives other than perhaps to let the law alone. Have you a final position with respect to that or do you wish to have more time to consider whether any change in the law might be desirable or beneficial to the industry?

Mr. MACPHERSON. I think that we presented a position based upon the limited analysis that we have done of the proposed bill and because of our management's travel schedules and the difficulty even with the corporation of coordinating a position, I don't

think I could comment any further than what we have today at this time.

Mr. KASTENMEIER. I appreciate that but it was suggested to me that you did not take a different position but rather that the industry hasn't had, perhaps, as much time as they might like to fully analyze the implications of any legislation to them.

Mr. FINCH. I would like to add, by the way, that we have not had time, considering the amount of time we had prior to this meeting, to take a positive position relative to what might be an alternative. We are concerned about the H.R. 1007 as it is currently construed. Given enough time, we might have a position. At this time we really don't have any positive alternative.

Mr. KASTENMEIER. Thank you, Mr. Finch.

Now I would like to yield to my colleague, Mr. Edwards.

Mr. EDWARDS. Thank you, Mr. Chairman.

We certainly haven't gone far enough in this hearing to even come close to a definitive decision. It's a very difficult area. We are pleased, of course, to have the testimony of these witnesses. Certainly, I can't think of any member of the committee or indeed of the House of Representatives that would want any legislation that would result in a morass of litigation. There's enough litigation in this country without inviting or inciting new litigation.

However, I am not persuaded by your Japanese instance. It seems to me that our relations with the Japanese are improving to such a degree that if there is a law passed in the United States, and with the favorable balance of payments that we have and which they cherish so dearly, why would they not comply with the copyright laws of the United States? Can you cite any other instances wherein a major way like this the Japanese do not comply with the U.S. laws?

Mr. EARLY. If I understand this matter, you have to realize I am not a lawyer, I believe that the Japanese, in copying the circuits in Japan and selling them in the world market, would, in no sense, be violating U.S. law. They would be acting completely within the normal constraints of U.S. law and if they went further and prohibited such copying in Japan, it would be a positive action on their part, independent of any existing law or proposal under this 1007 act.

Mr. EDWARDS. They couldn't bring the products into the United States.

Mr. EARLY. No, and I wouldn't expect them to.

Mr. EDWARDS. Certainly we could impose sanctions on them that would make their inclination to disobey American laws even at 5,000 miles, most unattractive. I repeat my question. Do you say that the Japanese would do this sort of thing? Do they do it now where copyrighted articles or patented articles are produced in Japan contrary to our law?

Mr. MACPHERSON. Let me try to answer the question. I can't say what the Japanese would do. I suspect they would adhere to our law. I suspect if they tried to import a product into the United States, whether it was a semiconductor chip or finished equipment, including semiconductor chips, that incorporated——

Mr. EDWARDS. I agree with you, I think they would.

Is the chief reservation here the idea that reverse engineering, which all the witnesses agree is appropriate, might be confused with pirating and that any kind of reverse engineering might be interpreted under this law as pirating?

Mr. MACPHERSON. I think that's one of the very strong concerns that we have, yes. There is a very gray area here in the very nature of reverse engineering, which would leave an individual engaged in that practice uncertain what his ultimate rights would be should he use that particular result in another product.

Mr. SHERIDAN. Excuse me. Mr. Edwards, I would like to address your previous question very briefly, if I might. I understood you to be asking if they would be respecting our copyright laws in terms of not copying articles in Japan for sale to the rest of the world. I am aware, drawing an analogy to patents, of many inventions patented in this country which are not patented in Japan and those inventions are mass produced in Japan and sold to the rest of the world.

I see no reason why the same would not be true on copyrighted articles.

Mr. EDWARDS. If that is going on in a wholesale or even limited fashion today, I would advise the people who are suffering and own the patent rights to get in touch with us or with Robert Strauss. That would be a strong bargaining point in our trade negotiations now going on with Japan.

Mr. FINCH. I would also like to make one comment relative to the Japanese question. I would like to propose it in a general way, not picking on the Japanese. As most of the witnesses here have indicated, the expense of R. & D. in our business is growing very fast and is very large in number. For that reason, no U.S. semiconductor company develops a product for the mass merchant marketplace that is not intended to be sold around the world.

If countries or from the United States work to reverse engineer products that were designed here and sell them around the world, they would be privy to roughly 40 percent of the market that is now attacked by the U.S. companies. Our foreign sales are a very large part of our total sales and, obviously, have a positive impact on our balance of payments.

If they have an unfair advantage in those markets it is not a very small percentage of our total sales, it is a very large percentage and, hence, they could be within the constraints of the U.S. laws and still have a dramatic advantage over the U.S. companies in foreign markets.

Mr. KASTENMEIER. The gentleman from California.

Mr. MINETA. Thank you very much, Mr. Chairman.

I am wondering, to get a little better idea of the industry itself, roughly, what would you say is the total employment in the semiconductor industry? Let's start right here in Silicon Valley. What number of employees are we talking about?

Mr. FINCH. I really don't have accurate numbers. I would have to guess between 70,000 and 100,000 people in Silicon Valley. It might be a little on the high side but I don't have accurate numbers for that.

Mr. MINETA. Leaving that aside, in terms of the total marketing effort in the semiconductor industry, comparing, let's say National

Semiconductor, Fairchild or any of the other companies, AMD, the others here, as compared to Intel, what company is, let's say, the largest or larger companies within the industry?

Mr. FINCH. If you take the U.S. semiconductor companies, Texas Instruments is a larger company than Intel. That's a Dallas based company. National Semiconductor is a larger company than Intel.

Mr. MINETA. Marketing or employees or both?

Mr. FINCH. I am going by sales. That's usually how we keep score. I am not sure just where Fairchild sits right now. Fairchild is a larger company than Intel. Intel is larger, I think, than most of the other companies that are in the bay area, such as AMD, Synetics, and AMI.

Mr. MINETA. Let me ask you, do those companies, as compared to say National Semiconductor, Texas Instruments, HP, Fairchild, where you have a lot of product lines, would you say that AMD, Intel, and some others, instead of being consumer oriented or something that would be available as far as their products being available to the consumer, that they are more concentrated with providing components or set assemblies that would be integrated into other pieces of equipment for industrial or business use rather than, let's say, a computer or calculator you might make or a watch that might be available. In other words, is there a distinction by companies in what they are doing with semiconductors? Are you getting yours in watches and other product lines as compared to some of the others that just make the chips for putting into someone else's product?

Mr. FINCH. That is not an easy question to answer because you really have to take a point in time.

Mr. MINETA. Maybe that's why we have to take a look at that ourselves in order to determine whether or not there are interests that have to be protected here through the copyright process. I think that it is important, at least for me to understand, whose ox is going to get gored and who has to be protected.

Mr. FINCH. I will do the best I can with that. First of all, you have to look at a point in time. I will use an example to indicate why. If you were to ask what companies make integrated circuits for the watch marketplace, had you asked that question 3, 4 years ago, the answer would have been almost everybody. If you ask that question today, National Semiconductor does that. To the best of my knowledge, Intel does not and Mostek does not, I don't think, although they have in the past. This has to be a fluid situation.

For instance, at this point in time, many of the companies, including Intel and Mostek, are preparing offerings for the communications market place. Four or five years ago there was almost no interest or effort in that area at all. I think in answer to your question, there are areas where National might have a vested interest. There are areas where Fairchild feels they have a vested interest. Certainly there are areas in which Intel or Mostek has a vested interest.

Mr. MINETA. Mr. Finch, if I may continue, your total sales are roughly what?

Mr. FINCH. We would do 700 million, roughly, in our fiscal year which ends as of May.

Mr. MINETA. In terms of research and development, how much will you be spending per year?

Mr. FINCH. Approximately 10 percent.

Mr. MINETA. In your research and development, how much of that is pure research and development as compared to applied research and development? How much of that is just being done for the sake of finding out more about what you are doing?

Mr. FINCH. Very little of our work is pure research and development. If we defined that as the type of work that might be done, say, at the university to further the interest of science, most of our R. & D. is aimed at either a specific product or a specific market area.

Mr. MINETA. Mr. Early, would you have any comments on this issue about the nature of the kind of companies that are involved here and as to their perspective of this legislation?

Mr. EARLY. I don't see that there are any significant differences in the companies here with respect to size and TI and Motorola, for example, are larger than any of the Valley companies.

Mr. MINETA. As it relates to semiconductors?

Mr. EARLY. If we take the numbers, I think it's roughly TI very much the largest, then Motorola, then I think National and Fairchild and Intel. The last three are not ridiculously far apart. TI just dwarfs the rest of us by a wide measure.

There is some difference in the narrowness of product line for Intel, say, as comparison. On the other hand, Fairchild has a very heavy investment in bipolar memories, which are other related technologies involving very complex chips.

Mr. MINETA. Tell me about the industry practice sharing or cross-licensing. Is that something that is widely done?

Mr. EARLY. It is widely done in a variety of arrangements. Anything from transferring actual mask sets and test information, written documents, all the documents necessary to bring a product to the marketplace back to simply a patent license which conveys no technology at all. Any variety arrangements in between, in fact, sometimes it goes to the point of sending teams of engineers, technicians, and workers to a new factory to help someone set up. Intel, for example, did that with respect to MIL in Canada not very many years ago. The practices are very complex and cover a wide spectrum.

Mr. MINETA. Do you pay for those cross-licenses?

Mr. EARLY. I would prefer Mr. MacPherson answer that.

Mr. MACPHERSON. Yes, companies receive consideration and the consideration can be in money or products given back in reverse.

Mr. MINETA. Would the passage of this legislation impede any of that kind of cross-licensing that occurs right now or the cooperation within the industry?

Mr. MACPHERSON. I really haven't thought about that question, to be quite frank. I would have to think about that. I don't know what the effect would be, this particular bill, if it were passed, on the current practices.

Mr. MINETA. The other comment I would like to make following up on what my colleague Mr. Edwards brought up. We always bring up this thing about retaliation by a foreign country, in this case, Japan. It seems to me we always use that as a sop to take any

kind of affirmative action sometimes when we need something that is visible and might have some jarring effect on some of our foreign competitors, including Japan.

You have been complaining to me about the NTN and the fact that the custom duties on that are going to be stretched out over years instead of reduced immediately. Maybe we need this to enforce that message to the Japanese to shorten it from the 8 years down to tomorrow or a year. They have already agreed to a reduction in terms of 30 percent. From what I hear the industry saying, they are complaining about the fact that it is going to be 8 years before the rates are down equal to what the United States charges them. Maybe we need the bad of this legislation or examples of this kind in order to get the message across to them.

Of course, the committee here, under the leadership of Chairman Kastenmeier, I know, is going to look into this thoroughly. Mr. Edwards is going to be looking at all the aspects of this legislation but it seems to me rather than talking about—I think in order to determine whether the need exists, we really have to determine what some of that mischief might be, whether or not there are benefits that would outweight the mischief.

Again, I would like to thank you very much for your presentation. Thank you, Mr. Chairman.

Mr. KASTENMEIER. Thank you, Congressman Mineta.

Does counsel have any questions? Mr. Lehman.

Mr. LEHMAN. Mr. Finch, does your company copy chips? I don't mean reverse engineering but do they use this photographic process of copying chips?

Mr. FINCH. Reverse engineering is to take a competitive chip, to take photographs of that chip.

Mr. LEHMAN. That's not what I mean.

Mr. FINCH. Tell me what you mean.

Mr. LEHMAN. Can we take one of your chips and find those two little fine lines that Mr. Grove, I believe it was described where you have actually photographed microscopically, a competitor's chip and then reproduced it exactly. Do you do that?

Mr. FINCH. To my knowledge at this time we are not doing that. But, then, again I qualify that. I don't know what each of the designers do. We certainly reverse engineer, as do all of our competitors, which is defined as looking in great detail at competitive chips and utilizing either in future designs or improved designs, the things we learn from those chips. It is standard industry practice.

Mr. LEHMAN. Would your company make a $10 million investment in chip design if it knew within 6 months another company would be producing the product?

Mr. FINCH. If the cost was $10 million and if the product was the right one for the marketplace, yes, we would. I would like to make an additional comment if I could relative to timing. As these chips get more complex, by the time a chip gets in the marketplace where we have bought the copy, the amount of time from start of design is anywhere from 18 to 24 months, maybe a little less if the chip isn't complex, and that constitutes the headstart. Mr. Early of Fairchild also indicated that it is not a simple matter of taking a chip or copy of a design and just running that in production. This

would imply that processes are exactly the same from company to company. All of us in this business know that is not true.

Mr. Grove indicated earlier there are small differences and these are the differences that really separate company from company in terms of their success level.

Mr. KASTENMEIER. Gentlemen, I want to thank you for your contribution here today. You have raised some questions about the desirability of the legislation. I would think in the weeks and months ahead we will give you an opportunity and many others a chance to fully explore this.

I perhaps should say for the record, perhaps the record does not disclose this, that our witnesses have been at the table, Mr. John Finch, who is vice president and general manager of National Semiconductor Products; Mr. George Rakonitz, who is vice president of strategic planning; Mr. James Sheridan, manager of patents and licenses; Dr. James Early—I am not sure, sir, what your capacity is for Fairchild.

Mr. EARLY. I am director of research and development and also a division vice president of research and development.

Mr. KASTENMEIER. And Mr. MacPherson, your title?

Mr. MACPHERSON. Patent counsel at Fairchild.

Mr. KASTENMEIER. Thank you, gentlemen.

That concludes our scheduled witnesses for today. I would want to ask whether Mr. Baumgarten has any contributions to make or whether there are any questions for Mr. Baumgarten. Then we would ask Mr. Grove if he desires any input or comment. I would appreciate of the panel leaving any further communications they desire to make to the subcommittee would be most welcome, that or any persons in your industry.

Mr. BAUMGARTEN. I would like to clarify something. This is a point that Mr. Mineta said—I am sorry, Mr. MacPherson. In response to Mr. Edwards and Mr. Mineta's question referring to exclusion of imported articles under the copyright law, I was talking about the importation of the chips themselves. Mr. MacPherson suggested that might extend to prohibiting the importation of other articles using the chips, watches, TV games, what have you. I think that's a question under the copyright law. I did not mean to imply that by protecting the chips under the U.S. copyright law you would enable customs to exclude the importation of articles which might embody chips in their operation.

Mr. Chairman, I think I can say quite honestly I agree with both parties. We agree with Intel; after the design there appears to be something worth protection. We agree with that. We agree with National and Fairchild that you should look beyond the terms of the amendment and look at the statute with which the amendment interacts so adjustments might be necessary.

Mr. Lehman asked earlier the question about whether you could simply rely on fair use to legitimatize some of these practices. I think that's one of the questions we suggested and it is one of the questions you picked up with respect to reverse engineering.

I think you probably, particularly yourself and Mr. Lehman and Mr. Mooney, as I did, had a great sense of dejavu here today. We go back to the hearings on the sound recordings amendment, design legislation and type face. All we have to do is substitute

some words. I think we have some of the very same arguments and the concern seems to be protected against direct duplication for a certain period of time but watch out it doesn't interfere with other things. All I can say is this is the type of investigation we have suggested. Whether you wish to do it on this bill alone or in context of Mr. Railback's law or another context on behalf of the office which we have in the past, we would be most happy to cooperate and offer any assistance we can.

Mr. KASTENMEIER. Thank you, Mr. Baumgarten.

Mr. Grove, would you like to make some comment? Were you surprised to learn so many people in your industry were opposed to the bill?

Mr. GROVE. I was, frankly. I think I can shed a little bit of light to your question, particularly, as to why the different responses.

I have four points to make. The first point of it is, I don't remember exactly who asked the question, perhaps you, Mr. Mineta, what the effect of this legislation would be on cooperations, it being the various companies in the industry. I would like to offer my own opinion on that. I believe I even indicated earlier in my testimony that there is cooperation taking place today. There is, in fact, within different companies in the industry, exchange of design information, such as masks and topographical design that would be protected by the proposed amendment.

Some companies participate in those, some companies don't. I think the existence of this amendment would put everybody on an equal footing with regard to that. There would be a standard. This is valuable information. It is not something you can have use of without the agreement of the original party, therefore, cooperation would be more widely used rather than anything in the other direction.

The second point I would like to make which came up listening to the testimony of National Semiconductor and Fairchild, having to do with us giving the foreign manufacturers an unfair advantage. That is simply not so, 70 percent of the consumption of integrated circuits takes place in this country. No manufacturer can succeed without supplying the American market. Whatever copyright violation, if this violation became law, whatever copyright violation in other countries, Japan, Germany, whoever, would do to use in the rest of the world would not amount to a hill of beans. It would not matter. They would have to come back and reimport a product into this country. Mr. Baumgarten indicated there are adequate remedies against that once the copyright became law.

Now, I would like to address the question, what is the difference? You were trying to find it by size of the various companies, types of markets they respectively serve. The answer to that is a little bit different. The answer to that is, indeed, the spectrum of products each of the companies devotes itself to. Intel may be smaller than National Semiconductor but Intel is the world's largest producer of large scale integrated circuits, they refer to as LSI, large scale integrated circuits, which are the complex portion of the integrated circuits spectrum.

As you remember the curve I showed, we are further along that curve at any given time for the average product that we make than

any other company. So, the first ox that is getting gored is ours. Fairchild and National will follow us up on that curve. In due course, they will realize that we cannot continue to operate as we have. At that point, I think they will begin to appreciate what we are talking about here today.

Today, since so much of the product line is the kind of product that is done on the curve, the design is very inexpensive and very simple, they have not suffered the consequences of that problem yet.

Last, I believe counsel of the committee asked representatives of National if National has ever copied. I believe Mr. Finch's answer was erroneous and I am prepared to put into evidence two sets of photographs showing Intel and National product each. I will label them in the back. This is an Intel 8000 bit programable reload memory. This is a photographic reproduction of the same thing put into manufacturing by National Semiconductor. This is the microcomputer Professor Angell claimed to be the grandfather of, the industry standard microcomputer called the 8080. This is the Intel version of it.

Perhaps, Mr. Kastenmeier, you might find an answer to your question about the different attitudes.

Mr. KASTENMEIER. It is useful for that purpose, although National Semiconductor is not on trial here. I should point out Mr. Finch qualified his answer by saying to his knowledge, not at this time. He didn't say never; but in any event, I will say that this does go to the point of differing economic interests part of it.

Mr. GROVE. Thank you very much.

Mr. KASTENMEIER. I would like to ask you just one question before I yield to Norm. Counsel suggested this, the differences in position of at least the panels of witnesses appearing today suggested that perhaps the whole of a circuitry of a chip might be protected and that the type of interest that other corporations have in a work by piecemeal or by reverse engineering or by segments or for other purposes, be excluded from protection. I don't think I agree. There is probably no such thing as fair use, probably any use. I agree with Dr. Early, any use probably would have economic detriment, an effect which in and of itself would suggest it was not, in fact, fair use. Examples, certainly, that you and Mr. Sevin suggested were a whole circuitry system and you also suggested that it wasn't very feasible to reproduce that except in its entirety. Therefore, the exceptions and uses referred to by Mr. Finch suggested that their interest and others could be in part of what competitors were doing and not necessarily reproducing the whole of a chip. How do you react to that analysis?

Mr. GROVE. Let me make sure I get the precise point of the question. Do I understand the question correctly that you are asking how do I react to somebody taking certain small parts of a total design rather than the total design itself?

Mr. KASTENMEIER. What I am asking, in a sense, is if the bill were to protect only the totality, all of it, that is to say only if reproduced in its totality. Those were the examples that you and Mr. Sevin chose, in its totality and not protect in any way whatsoever partial or reverse engineering reproduction of the content of the chip.

Mr. GROVE. I am sure we would have to find a legal answer to this. Let me try to explain to you the practical answer; how do we reduce that to legal language. That is a job that needs to be done. Merely restricting the legislation to precise and exact photographic copies could be circumvented by something no more difficult than taking Mr. Sevin's example with the metal that serves no useful purpose and erasing that from the photograph, retouching the photograph, as it were, and all the rest of it could be copied; or by taking one of those little areas and in the process of photographing, locating it a little distance away from where they are in the original.

Mr. KASTENMEIER. I understood from the earlier testimony that it was not feasible.

Mr. GROVE. It is feasible. It was not done because the perpetrators of that particular copy did not find it necessary to take the trouble. If there was legislation, however, that said that photographic copy has to be precise in its totality, it would be somewhat equivalent to maybe, maybe I am naive in this one, to have book copyrights saying it is all right so long as you move the page number to the right side from center. We would not buy a great deal. On the other side, I have no real objection to reverse engineering which requires something totally different than photographic copy. It requires engineers to go back and understand what they have there and reconfigurate on their own.

The objection to these two extremes will be it is going to be difficult to find what portion, is a 10-percent rearrangement OK, does it require a 20-percent rearrangement. These are matters of law and these are probably matters that would even have to be resolved in the court. I would be happy to have a word like substantial change and have the opportunity to go to court and prove that something is or is not a substantial change.

Mr. KASTENMEIER. Certainly all the items cited today involved really a total of "pirating" of the work.

Mr. GROVE. That is correct. I might add, we put the copyright sign on all of our chips and the copying was not totally complete. The copyright sign was removed.

Mr. MINETA. I would like to ask Dr. Grove, in your statement today, were you representing Intel as a corporation but also AMA?

Mr. GROVE. Yes, I was.

Mr. MINETA. Has the SIA, the Semiconductor Industry Association, taken a stand on this?

Mr. GROVE. No, they have not.

Mr. MINETA. AEA has taken this as their formal position, relative to H.R. 1007?

Mr. GROVE. That is my understanding.

Mr. KASTENMEIER. Would you identify AEA for us?

Mr. MINETA. AEA is the American Electronics Association. It is the leading trade organization in the country.

Mr. KASTENMEIER. Thank you very much. I would like to take this opportunity, in conclusion, to thank all of you for your interest in this public question. I particularly, however, want to express my personal thanks and that of the committee and Congressman Don Edwards and Congressman Norman Mineta, my colleagues for their hospitality and their help and their interest in this question.

It is obviously not the last chapter but merely the opening chapter of the public question we have addressed today.

I would like, in conclusion, to express my thanks and that of the committee. It is a treat to come here to San Jose and join my colleagues.

Mr. EDWARDS. Mr. Chairman, on behalf of Norm and I and Pete and all of the people in this valley, we would like to thank you for coming. This is the first congressional hearing in our history in San Jose and we hope you come back.

Mr. KASTENMEIER. The committee stands adjourned.

[Whereupon, at 5:30 p.m., the hearing was closed.]

[Additional statements submitted for the record:]

GENERAL INSTRUMENT CORP.,
Washington, D.C., May 4, 1979.

Hon. ROBERT KASTENMEIER,
Chairman, Subcommittee on Courts, Civil Liberties, and the Administration of Justice, Committee on the Judiciary, U.S. House of Representatives, Rayburn House Office Building, Washington, D.C.

Re: H.R. 1007

DEAR REPRESENTATIVE KASTENMEIER: Enclosed please find a statement on behalf of General Instrument Corporation on H.R. 1007, a bill to extend copyright protection to the manufacture of integrated circuits.

We regret our inability to appear at the hearings on this bill which were held in San Jose, California on April 16, 1979. We submit this statement in lieu of testimony and request that it be made a part of the formal hearing record on the bill.

Thank you for your interest and concern about the semiconductor industry, an industry which we believe is of major service to the American people and the American economy.

Sincerely,

QUINCY RODGERS,
Director,
Governmental Affairs.

Enclosure:

STATEMENT OF GENERAL INSTRUMENT CORP.

General Instrument Corporation (GI) appreciates this opportunity to comment on H.R. 1007, a bill intended to protect the interests of integrated circuit manufacturers by extending copyright protection to the masks used in circuit fabrication.

As the industry pioneer in the development of metal-oxide-silicon (MOS) integrated circuit technology, and as a leading innovator in the development of MOS circuits, GI appreciates the need to protect companies which have invested money and time in the development of innovative designs. However, because we are convinced, after careful reflection, that the copyright laws are the wrong means for providing this protection, we oppose the enactment of H.R. 1007 in its present form.

During the 1960's and early 1970's GI led the way in commercializing the MOS technology now widely practiced by the semiconductor industry. That technology is responsible for one of the major technical and social revolutions of our age: the availability of enormous computational power and data memory at very low cost. Consumer products such as calculators and video games represent only the earliest and most visible products of that revolution; MOS integrated circuitry used in such fields as computer, household appliances, automobiles, office equipment, telecommunications, and the like will, over the next few years, dramatically affect the lives of people the world over.

It is, therefore, clearly in the public interest to encourage the development of innovative technology in this field and the rapid diffusion of that technology, so as to make the benefits of innovation widely available at low cost. The issue thus has two aspects:

How to appropriately protect and reward innovators; and

How to assure that competition will distribute the benefits of innovation to the widest possible market at the lowest possible cost.

The basic deficiency of H.R. 1007 is that it gives the innovator far more protection than is needed and unnecessarily stultifies the diffusion process.

H.R. 1007 would radically alter the fundamental groundrules under which American industry has flourished. At the risk of oversimplifying a vast and complex body of law, the basic principles can be summarized as follows:

1. As the Supreme Court has repeatedly reaffirmed, our deep commitment to a strong competitive system means that competitors *should* be permitted to imitate successful innovations—and, except as specifically limited by the laws pertaining to intellectual property (see below), even to copy those innovative products down to the last detail. The entire economy benefits from this process, and efforts to stifle it must be carefully and cautiously analyzed. No rhetoric of "piracy" should be permitted to obscure the fundamental public interest in permitting the diffusion of innovation through imitation and copying.

2. There are essentially only three exceptions to that principle:

Those whose innovations rise to the standard of true *inventions* are entitled to patent protection confering a limited monopoly in the inventions. By definition, this bill would grant monopoly protection to products which are *not* inventions.

H.R. 1007 is an attempt to fit into copyright law material which is more properly the subject matter of patents. The distinction between copyright and patent was expressed initially by the Supreme Court in *Baker* v. *Selden* 101 U.S. 99 (1879).

"The description of the art in a book, though entitled to the benefit 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. The former may be secured by copyright. The latter can only be secured, if it can be secured at all, by letters patent."

Literary, musical and artistic creators are similarly entitled to copyright monopolies in their works. Clearly, integrated circuit masks do not fall within this category.

Congress, in the First National Copyright Act in 1790, extended copyright protection to "books, maps and charts". Over the course of nearly two centuries, the law has been amended and revised to include musical compositions, dramatic works, photographs, motion pictures and less traditional forms of expression, such as, sound recordings and computer programs.

In every case in which copyright protection has been afforded to a category of works, the works have been those which communicate with humans. Even computer programs, which it can be argued "operate" machines, are capable of being read and understood. The integrated circuit chip conveys no information. It is a machine which communicates only with other machines. It bears no resemblance to other forms of pictorial, graphic or sculptural works which are protected by the copyright law. If it did, it would be protected under the 1976 Copyright Act without the need for this amendment. To fit integrated circuit chips into the copyright law would require what John Hersey, in his dissenting position in the Report of the National Commission on New Technological Uses of Copyright Works (CONTU) has called "distortion by shoehorn".

All innovators are entitled to protection against imitation and copying *by illicit means*, such as industrial espionage, or inducing employees to breach their obligations of trust with respect proprietary information. H.R. 1007 does not deal with this issue—an issue which, in our view, is far more significant and critical to the semiconductor industry than the issue the bill does deal with.

These fundamental principles have served the nation and the semiconductor industry well. The proposed bill would radically alter those principles by granting monopoly protection to those integrated circuit designs which neither rise to the standard of invention required under the patent laws, nor contain artistic value, and which are limitated without resort to illicit means. To do so would be to create an entirely new species of property right unprecedented in the American competitive system. If the principles which underlie H.R. 1007 are valid when applied to the semiconductor industry, then they are equally valid in the case of every other manufacturing industry. There is no distinction in principle between integrated circuit masks and the tools which are used to fabricate any other manufactured product. If integrated circuit designs are to be given monopoly protection even though they do not constitute inventions, then there is no reason not to similarly protect *all* industrial designs. Clearly, this would constitute a revolutionary step in the law of intellectual property and in our competitive system.

It cannot be argued that copyright protection is uniquely needed by our industry to provide the incentive for companies to invest in developing innovative designs. The indisputable fact is that the existing economic incentives encouraging and rewarding innovation in the field of integrated circuitry are already enormously powerful: the creative energy of the semi-conductor industry, the dynamic pace of

innovation in that industry, and the rapid growth and financial success of innovative companies are convincing evidence of that fact. The payoff for successful innovators is huge; indeed, an entire multi-billion dollar industry based upon continuous innovation has evolved in the past decade without the dubious benefit of copyright protection. This is so because the economics of the semiconductor industry are such that the lead time gained by an innovator in itself strongly tends to protect its investment in innovation.

It should be pointed out that our views on this legislation do not reflect any interest of GI in copying the designs of others: not only have we never done so, but, on the contrary, other firms have copied a number of our successful designs. Rather, we oppose this legislation because we think it is harmful to the semiconductor industry in four critical respects:

First, it is harmful because its practical effect would be to slow the pace at which innovative technology is diffused through the industry. Claims of copyright protection and threats of litigation would be used to intimidate competitors from analyzing and imitating competitive products, a process which ultimately leads to further improvement and fresh innovation. The stultification of that process would be detrimental not only to consumers, but, ultimately, to the industry itself.

Second, it is harmful because it reflects an astonishingly defeatist attitude: it implies that our industry needs special protection not applicable to other industries. Unlike the advocates of H.R. 1007, we are confident of our ability to gain and maintain our position in the marketplace under the same competitive rules that are applicable to industry generally. The invocation of foreign competition to justify this legislation is, we think, entirely inapposite. Ours is a strong industry, capable of meeting—and, indeed, benefitting from—tough competition from abroad. To the extent that foreign companies obtain special advantages from their home governments, or prevent American firms from competing on an equal footing in their home markets, legislative or other governmental responses may be appropriate; but the creation of a copyright monopoly is at best a clumsy and, indeed, irrelevant response, likely to do more harm than good in the international arena.

Third, it is harmful because H.R. 1007 does not grow out of considered dialogue with all interested parties. If there is a problem with copying, any legislative response ought to reflect the views of the industry and its customers, and not simply those of a segment of the industry.

Finally, and most significantly, it is harmful because it distorts the industry's legislative priorities. There are genuine challenges facing this industry, some of which may deserve Congressional attention. Among these problems are:

Regulatory policies and practices which impose unjustified costs upon domestic manufacturers;

Inequities in tax structure and imperfections in capital markets which limit the availability of venture capital for innovative young corporations;

Inadequate governmental support for major research and development, particularly as compared with other countries;

Unnecessary export controls.

Indeed, within the field of protecting intellectual property, (such as designs, processes and other valuable technology) the problem of obtaining prompt, effective and low-cost remedies against the misappropriation of proprietary information by *illicit* means deserves, in our view, a far higher priority than the problem of copying designs which have been disclosed to the marketplace.

We would be glad to work with the Committee and with all interested parties to develop sound and broadly based legislation to respond to the real challenges confronting our industry.

ROBERT B. SHAPIRO,
General Counsel,
General Instrument Corp.

NEW YORK COUNTY LAWYERS' ASSOCIATION,
New York, N.Y., May 17, 1979.

MY DEAR SIR: Enclosed please find copy of report adopted by the Committee on Federal Legislation of the New York County Lawyers' Association on H.R. 1007.

Very truly yours,

RICHARD A. GIVENS,
Chairman.

REPORT NO. F-2—COMMITTEE ON FEDERAL LEGISLATION PROPOSED BILL TO AMEND THE COPYRIGHT ACT TO PROVIDE COPYRIGHT PROTECTION FOR IMPRINTED DESIGN PATTERNS ON SEMICONDUCTOR CHIPS

RECOMMENDATION: REVISION

This legislation is part of a continuing effort to give some intellectual property protection to the computer industry. Amendment of the Patent Act to achieve this is not considered likely, though perhaps some form of "petit patent" will be devised to accomplish this goal. At present, however, this proposed amendment of the Copyright Act is a useful step in the right direction.

As presently drafted, the amendment would not cover anything but chips manufactured for semiconductors. The drafters have not taken account of a host of other uses of the same technology of photo-etching. A recently granted patent is attached, illustrating another use of the same technology.

It is recommended that the new sentence that commences in line 6 be amended to read as follows:

> Such pictorial, graphic, and sculptural works shall also include the master photographic masks which are photographically enlarged or reduced and used to imprint patterns on materials that are chemically, mechanically or electronically etched or built up so as to produce complex parts, integrated circuit chips, flexwired circuitry, jewelry, etc., and include the imprinted patterns themselves even though they are used in connection with the manufacture of, or incorporated in, a useful article.

Respectfully submitted,

RICHARD A. GIVENS, *Chairman*
(And 27 others).

TEXAS INSTRUMENTS, INC.,
Dallas, Tex., May 24, 1979.

Hon. ROBERT W. KASTENMEIER,
Chairman, Subcommittee on Courts, Civil Liberties, and the Administration of Justice, Committee on the Judiciary, House of Representatives US Congress, Washington, D.C.

DEAR MR. CHAIRMAN: We at Texas Instruments Incorporated followed with considerable interest your recent field hearings on H.R. 1007, legislation which would extend copyright protection to cover design features shown on the surface topology of an integrated circuit.

Given the importance of this proposal, I am submitting the enclosed statement which outlines the reasoning which has led to our determination to recommend against passage of the legislation. I would appreciate your making it a part of the hearing record in order that the Subcommittee might have the benefit of the views of Texas Instruments.

If I may be of assistance to you or your colleagues during your further deliberations on H.R. 1007, or similar proposals, I hope that you will call on me.

Sincerely,

GEORGE H. HEILMEIER,
Vice President,
Corporate Research, Development and Engineering.

STATEMENT OF GEORGE H. HEILMEIER, VICE PRESIDENT, CORPORATE RESEARCH, DEVELOPMENT, AND ENGINEERING TEXAS INSTRUMENTS, INC.

Mr. Chairman and Members of the Subcommittee, On January 18, 1979 Representatives Don Edwards, Norman Mineta and Paul McCloskey, Jr. introduced legislation (H.R. 1007) that would extend copyright protection to the design pattern on the surface of an integrated circuit. Texas Instruments Incorporated is opposed to this proposed legislation for the following reasons:

RESTRAINT ON TRADE

The proposed legislation would establish a new form of protection that Texas Instruments believes would unduly restrain competition in the semiconductor industry. In addition, enactment would impede the dissemination of new technology and increase the cost to the consumer of products which utilize semiconductor industry technology. To date, the consumer has directly benefited from the semiconductor industry practice of manufacturers providing alternate sources for products introduced by their competitors. The result has been a rapid infusion of new technology and lower product costs. The proposed legislation would prohibit much of this alternate source practice, and the consumer would not benefit from price and product availability resulting from free competition, but rather would find the price and product availability sheltered under a monopoly position provided by copyright protection covering the product design.

Texas Instruments believes that the new form of copyright protection which would be provided by the proposed legislation could constitute a restrictive trade practice that could be challenged in court. This holds true given the fact that the alternate source practice in the SC industry has been credited with promoting competition. For example, the FTC conducted a survey of the structure, conduct and performance of the semiconductor industry, and concluded in its January 1977 Staff Report that the industry was characterized by rapid innovation and technological change and that the freedom to provide alternate sources to products of competitors was very important.

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

COMPLEXITY AND UNCERTAINTY

The market which the SC industry serves demands that alternate sources be available for SC products. For example, OEM's (original equipment manufacturers) and the Department of Defense generally refuse to design SC products into their equipment unless there are multiple sources. To date, the practice of the SC industry has facilitated alternate sourcing and has resulted in rapid infusion of new technology into end-equipment. Under the proposed legislation, the alternate source activity permissible as "Reverse Engineering" is not clear. A profusion of litigation would seem to define the boundaries of permissible activity. A manufacturer would always have a contingent legal exposure should an argument of copyright infringement be raised. This would discourage new entrants into the industry and slow the infusion of new technology. It would also force a proliferation of formal second-source agreements between competitors who desire to provide alternate source products. While the formal second-source agreements would obviate the legal exposure under the proposed legislation, they could increase the risk of challenge under the anti-trust laws by a disgruntled manufacturer denied a copyright license or by the Justice Department, challenging a joint development program between two competitors as constituting an agreement in restraint of trade. At the very least, enactment of H.R.1007 would impose a substantial burden on manufacturers in order to administer new license arrangements and to police against infringement. Texas Instruments does not believe that the proposed legislation (with its attendant administrative cost burden) is necessary in order to provide an incentive to conduct research and development. Rather, TI believes the economic rewards for research and development are obtained from the competitive advantage in being first to the market place with new products.

INCONSISTENT WITH PATENT LAWS

The patent law has been formulated to promote the progress of science and useful arts by providing protection for a new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof. The inventor receives a monopoly for 17 years, but only in return for fully disclosing the invention to the public and following an examination for patentability. The public, of course, is free to use the invention after the expiration of the patent.

The proposed legislation directly relates to "science and useful arts"—the province intended to be covered by patent law. Further, the proposed legislation would provide even broader protection than the patent law inasmuch as no examination would be required prior to grant of the right, and since the protection would extend beyond the term of a patent. By way of illustration, the patent could disclose the

chip design layout of an integrated circuit. Under the patent system, the public would be free to use the invention upon expiration of the patent. Features of the surface topology, however, would also be covered in a copyright under the proposed legislation such that any licensee under the patent may also be infringing the copyright. This would have the effect of extending the patent monopoly beyond its 17 years, since the copyright owner could still foreclose competition after 17 years, relying on his copyright. Even if the monopoly granted by the proposed legislation were limited to less than 17 years, the uncertainty of enforcement and other disadvantages mentioned make this proposed legislation undesirable.

In summary, Texas Instruments believes that the proposed legislation is not necessary to provide an incentive to carry on research and development. TI believes it would be an undue restraint on trade, would add substantial cost and confusion to doing business in the SC industry, and would create rights which are inconsistent with the purpose and application of the U.S. patent laws.