PERSPECTIVES IN NANOTECHNOLOGY

CRC Press
Taylor & Francis Group

NANOTECHNOLOGY

Legal Aspects

Patrick M. Boucher

NANOTECHNOLOGY

Legal Aspects

PERSPECTIVES IN NANOTECHNOLOGY

Series Editor
Gabor L. Hornyak

Nanotechnology: The Business, Michael T. Burke
Nanotechnology: Education and Workforce Development, Gabor L. Hornyak
Nanotechnology: Ethics and Society, Deb Bennett-Woods
Nanotechnology: Health and Environmental Risks, Jo Anne Shatkin
Nanotechnology: Legal Aspects, Patrick M. Boucher

PERSPECTIVES IN NANOTECHNOLOGY

NANOTECHNOLOGY

Legal Aspects

Patrick M. Boucher

CRC Press
Taylor & Francis Group
Boca Raton London New York

CRC Press is an imprint of the
Taylor & Francis Group, an **informa** business

CRC Press
Taylor & Francis Group
6000 Broken Sound Parkway NW, Suite 300
Boca Raton, FL 33487-2742

Printed in the United States of America on acid-free paper
10 9 8 7 6 5 4 3 2 1

International Standard Book Number-13: 978-1-4200-5347-0 (Softcover)

Library of Congress Cataloging-in-Publication Data

Boucher, Patrick M.
Nanotechnology : legal aspects / Patrick M. Boucher.
p. cm.
Includes bibliographical references and index.
ISBN 978-1-4200-5347-0 (alk. paper)
1. Nanostructured materials industry--Law and legislation. 2. Nanostructured materials industry--Law and legislation--United States. I. Title.

K3924.H54B66 2008
343'.0786205--dc22 2007037938

Visit the Taylor & Francis Web site at
http://www.taylorandfrancis.com

and the CRC Press Web site at
http://www.crcpress.com

For Dad

Contents

Series Foreword

Welcome to the Perspectives in Nanotechnology Series—a group of short, readable paperback books dedicated to expanding your knowledge about a new and exciting technology. The book you are about to read involves subject matter that goes beyond the laboratory and the production line. It is not about technical details—the book you have taken on board your connecting flight, commuter train or bus or to your hotel room involves a specific aspect of nanotechnology that will have some impact on your life, the welfare of your family and the wealth and security of this nation. The degree of this impact may be unnoticeable, slight, overwhelming or any place in between those extremes depending on the specific application, its magnitude and the scope of its distribution. Those of us who are able to recognize trends, conduct efficient research, plan ahead and adapt will succeed in a new world enhanced by nanotechnology. This book in the Perspectives in Nanotechnology Series hopefully will act as the catalyst for your *fantastic journey*.

Each book in the series focuses on a selected aspect of nanotechnology. No technology exists in a vacuum. All technology is framed within the contexts of societal interactions, laws and practices. Once a technology is introduced to a society, the society must deal with it. The impact of a technology on culture, politics, education and economics depends on many complex factors—just reflect for a moment on the consequences (good and bad) of the computer, the automobile or the atomic bomb. Nanotechnology is designated to be the "next industrial revolution." Although there is much hype associated with nanotechnology, the ability to manipulate atoms and molecules in order to fabricate new materials and devices that possess remarkable properties and functions alone should be enough of a hook to draw you in.

The impact of new technology is more relevant than ever. Consider that our world is highly integrated, communication occurs instantaneously and that powerful geopolitical and economic pressures are in the process of continually changing the global landscape. We repeat—the degree of the impact of nanotechnology may be unnoticeable, slight, overwhelming or anyplace in between. Those of us who are able to recognize trends, conduct efficient research, plan ahead and adapt will succeed. It is all about survival. It always has been. Darlene Geis in her book, *Dinosaurs and Other Prehistoric Animals*, states:

> …and finally even the mighty T-Rex died out, too. His size and strength and remarkable jaws were of no use to him in a world that was changing and where his food supply was slowly disappearing. In the end, the king was no greater than his subjects in a world whose rule has always been Change with Me—or Perish![1]

Although stated with a bit of drama, the quotation does bring the point across quite effectively. Your future is in your hands—perhaps holding this very book.

Societal Implications

Societal aspects (implications) consist of a broad family of highly integrated components and forces that merge with technology to form our civilization. Government, business, academia and other social institutions have evolved over millennia and are in a constant state of dynamic flux. Civilizations change for many reasons. Technology always has been one of the primary drivers of this change. The change may be beneficial, detrimental or anywhere in between. From the first stone implement, the iron of the Hittites to the microchip, technology has always played a major role in the shaping of society. Societal implications of nanotechnology are rooted in the technology. Societal implications in turn have the capacity to alter any technology. How many times have social forces inspired a new technology? The technology developed in the space program is one example of such a relationship—the development of penicillin another.

What exactly are "societal implications"? How do they relate to nanotechnology? In this series, we intend to cover a wide variety of topics. The societal implications of nanotechnology are both numerous and diverse and encompass the legal, ethical, cultural, medical, and environmental disciplines. National security, education, workforce development, economic policy, public policy, public perception, and regulation are but a few of the areas we plan to address in the near future.[2] All aspects of government, business and academia are subject to the influence of nanotechnology. All vertical industrial sectors will be impacted by nanotechnology—aerospace, health care, transportation, electronics and computing, telecommunications, biotechnology, agriculture, construction and energy. For example, all Fortune 500 companies already have staked a claim in nanotechnology-based products. Service industries that focus on intellectual property and technology transfer, health and safety, environmental management and consulting, workforce sourcing and job placement, education development and curriculum, and investment and trading already engage the challenges brought about by nanotechnology. There is no lack of subject matter. We plan to cover the most urgent, the most relevant, and the most interesting topics.

Ethical implications are associated with every form of technology. Artificial intelligence, weapon systems, life-extending drugs, surveillance, altered organisms and social justice all have built-in moral implications—ready for us to discuss. Nanotechnology is creating new ethical dilemmas while simultaneously exacerbating (or alleviating) older ones. Nanotechnology

is already changing our legal system. How does one go about obtaining a patent of a process or material that is the result of an interdisciplinary collaboration, e.g., the convergence of engineering, chemistry, physics and biology? Even more so, the environmental footprint of nanotechnology is expected to be three orders of magnitude less than that of any current technology. The health (and environmental) consequences of nanomaterials are mostly unknown. And what of public perception? How many of you want a nanotech research center in your back yard (are you a NIMBY)? How should we update our educational system to accommodate nanotechnological topics? What should we do to make sure our workforce is current and prepared? How will your job or career be influenced by nanotechnology?

There are other relevant questions. How does one go about building a nanobusiness? What new kinds of partnerships are required to start a business and what exactly is the *barrier of entry* for such an undertaking? What are *nanoeconomic clusters*? What Fortune 500 companies and what business sectors require a book in this Series to describe its NT profile? And what of investing and funding? What is the status of nanotechnology programs on the international stage? What about nanotechnology and religion? What about the *future of nanotechnology*? The list goes on.

The Books

Web resources that address societal implications of nanotechnology are plentiful but usually offer encapsulated or cursory information. On the other hand, comprehensive (but tedious) summary reports produced by research and marketing firms are suitable for the serious investor but require a major financial commitment to procure and therefore, are generally not available to the public at large. In addition, government entities, e.g., the National Nanotechnology Initiative (http://www.nano.gov), have generated comprehensive reports on the societal impact of NT.[1,2] Such documents, although excellent, are generally not well known to the public sector. A reader-friendly, affordable book with commercial appeal that targets the nano-aware (as well as the unaware) layperson or expert in the field offers a convenient alternative to the options listed above.

The intent of each book is to be informative, compelling and relevant. The books, in general, adhere to the criteria listed below.

- **Readability**. Each book is 200 to 300 pages long, with easy-to-read font and is abundant with non-technical but certainly non-ponderous language.
- **References**. Each book is well researched and provides links to more detailed sources when required.

- **Economical Pricing**. Each book is priced within easy reach and designed for accelerated distribution at conferences and other venues.
- **Subject Matter**. The subject of each book is relevant to nanotechnology and represents the cutting-edge in the state-of-the-art.
- **Relevance**. The books are dynamic. We must stay current if we are to abide by T-Rex's rule! Specifically, the content will stay relevant in the form of future editions as the climate of nanotechnology is expected to change dynamically over the years to come. A strong temporal component is inherent in the Perspectives in Nanotechnology Series.

It is our hope that readers delve into a book about their special interest but also to transform themselves into a state of *nano-readiness*. Are you nano-ready? Do you want to be able to recognize the drivers that surround nanotechnology and its potential promise? Do you want to be able to learn about the science, technology and potential implications? Are ready at this time to plan and adapt to changes? Do you want to become an agent of change? Do you want success in that future? If your answers are, in order—NO, YES, YES, NO, YES and YES—you are ready to begin reading this book.

Gabor L. Hornyak
Series Editor

References

1. D. Geis, *Dinosaurs and Other Prehistoric Animals*, Grosset & Dunlap, New York (1959).
2. M.C. Roco and W.S. Bainbridge, Eds., *Societal Implications of Nanoscience and Nanotechnology*, National Science Foundation, Arlington, Virginia (2001).
3. M.C. Roco and W.S. Bainbridge, Eds., *Nanotechnology: Societal Implications—Maximizing Benefits for Humanity*, Report of the National Nanotechnology Initiative Workshop, December 2–3 (2003).

Author

Patrick M. Boucher holds a Ph.D. in physics (Queen's University, Canada) and a J.D. (Touro College, United States). His technical publications have been in the areas of condensed matter, nuclear, and astrophysics. For several years, he was associated with *Physical Review B*, which publishes much of the world's technical nanotechnology research and where he acted as associate editor and managed the journal's scientific editorial staff. He is currently a patent attorney practicing in Denver, Colorado, as a partner of Townsend and Townsend and Crew LLP.

Introduction

In April 2006, Magic Nano, a commercial product designed to render glass and ceramic surfaces repellant to dirt and water, was recalled by the German government because of reports of respiratory problems experienced by some seventy people during a one-week period in March 2006. In July 2006, Elan Pharmaceuticals filed a lawsuit against Abraxis Bioscience, Inc., alleging that the drug Abraxane, a nanoparticle formulation of paclitaxel marketed by Abraxis for the treatment of metastatic breast cancer, infringed patents owned by Elan. Just before Christmas 2006, demonstration of surface conduction electron emitter displays—a new alternative to LCD and plasma displays based on nanotechnology—was prevented by a lawsuit filed by Nano-Proprietary against Canon.

These are just some of the legal issues surrounding nanotechnology that have begun to surface in the news. In many ways, nanotechnology has so far been surprisingly immune to entanglement in public legal issues, although there is no question that prudent nanotechnology companies have had legal advice to position themselves for addressing a variety of issues. But for the most part, researchers have so far been able to conduct their investigations with relatively little concern about various legal ramifications.

Such a circumstance is unlikely to continue. As nanotechnology continues to be developed and as financial interests become more important, legal doctrines are increasingly likely to play an important role. Particularly as nanotechnology continues to be used in commercial products, private parties will use the mechanisms that the law provides to try to develop and exploit financial advantages. Governments will also increasingly become involved with integrating nanotechnology into a broader legal framework that allows for a variety of different concerns to be addressed. It is already the case that existing laws have a generality that permits them to be applied to nanotechnology and the illustrations above represent just a small example of ways in which those existing laws are actively being used. It is also certain that as nanotechnology becomes more pervasively included in products, governments will feel compelled to generate legislation targeted to issues specific to nanotechnology.

This book provides an analysis of some of the legal issues that surround nanotechnology. At its most fundamental level, the recognized purpose of laws in society is to control people's behavior. The manner in which laws affect such control varies depending on circumstances and may sometimes be manifested as incentives designed to encourage people to engage in activity that society views as beneficial. The converse of such an approach is realized in laws whose purpose is instead to punish those who engage in activity that society deems unacceptable or otherwise undesirable.

Nanotechnology provides a cogent example of a discipline that is subject to a wide range of laws including those that act as a carrot to incentivize desirable behavior and those that act as a stick to discourage unacceptable activities. The spectrum of laws classified in this way approximates a lifecycle that might be assigned to a nanotechnology product. At one end of the spectrum are laws that may be used to encourage researchers to apply their intellectual abilities to developing the science and engineering used in producing nanotechnology products. These laws include mechanisms for recognizing that what these researchers develop is their "intellectual property" and that this has value. The law provides a significant number of rights depending on the character of what is developed.

At the other end of the spectrum are laws that are intended to hold individuals responsible for their actions, either by punishing them for engaging in behavior viewed as contrary to the objectives of society or by requiring them to compensate those whom their behavior harms. Such laws may come into play when a product that incorporates nanotechnology is used in a manner that causes harm to individuals. A number of issues are relevant to assigning liability for the harm in such circumstances, with criminal laws focusing on punishment by the state and civil laws mostly focusing on providing private compensation to injured parties.

Intermediate in this spectrum are a variety of regulatory laws. The regulation of activities reflects an attempt by society to act preemptively to prevent certain results from occurring. In this way, such laws differ from those that are specifically designed to encourage behavior or are specifically designed to punish behavior. This difference in approach is reflected in the way in which most regulatory restrictions are implemented. Rather than enact specific laws to govern activities in this preemptive way, lawmakers create a regulatory body that has expertise in the relevant area and delegate a portion of their power to that body. The regulatory body then generally has a more direct interaction with the community that is most affected by limitations on its activities, providing mechanisms to solicit input from that community before promulgating restrictive rules.

This book is organized in three parts that address different portions of this legal spectrum. The first part, "Protection," describes mechanisms by which creative and inventive parties may obtain control over their developments, particularly in a manner that allows those developments to be exploited for financial gain. This first part discusses how developers of nanotechnology products may obtain and enforce patents, copyrights, and other forms of intellectual property. The second part, "Regulation," provides an overview of some of the existing regulatory bodies that will impact the practical use of nanotechnology. By no means are all bodies that could potentially regulate nanotechnology discussed in this section; rather the section uses illustrations of a number of different regulations to demonstrate different kinds of approaches that might be taken in regulating nanotechnology. The final part of the book, "Liability," focuses on a variety of different legal doctrines that may be used to hold parties responsible for their actions. While

the greatest bulk of that part addresses negligence and product-liability doctrines that have their basis in civil law, some discussion is also provided of the potential impact of criminal-law principles to nanotechnology.

The discussion of these principles is intended to be relatively general throughout the book, but it is necessary in many instances to provide at least some specific details as to how the law applies. When this is done, I have used U.S. law, which is the body of law with which I am most familiar. This should not detract significantly from the main thrust of the book, which is to illustrate how nanotechnology is affected by different legal principles. In particular, this book is not intended to be a legal treatise. In many instances, I have simplified some of the subtleties of certain legal doctrines or ignored some exceptions that could apply in order to bring out the concepts I am hoping to illustrate more plainly. The book should therefore not be relied upon to provide the answer to any specific legal question. A competent attorney who is aware of case-law developments that have occurred since this book was written and who is familiar with the precise details and exceptions of the relevant legal doctrines is essential.

Even though U.S. law has been used for illustrative purposes, it is worth remarking that even such a concept is not necessarily well defined. The United States is structured as a federal system in which a large number of states are considered fundamentally to be independently sovereign. They have yielded some of this sovereignty to the national (or federal) government, which is able to legislate in certain areas, but have retained significant power for themselves. In this kind of context, discussions of legal principles are made in a generalized fashion, with the recognition that each jurisdiction may include its own unique variants to the generally prevailing views. In many respects, the same kinds of differences exist when considering the laws of other nations. While there are certainly variations among different countries—and while the variants in an international context may well be larger than the variants within a single country like the United States—most of the generalized principles still apply. The simple fact is that the same kinds of legal issues need to be addressed in all countries and, for the most part, similar principles are developed.

Notably, this book is one of a series of texts that discuss the societal implications of nanotechnology. As Louis Hornyak notes in his foreword, the series of books attempts to provide some perspective on these societal impacts, with a broader outlook being available by considering the ways in which different disciplines intersect and provide different viewpoints of similar issues. In some respects, it is not a trivial task to demarcate the separate subjects that are addressed in the series, and there is inevitably some overlap between various of the books.

The reader is encouraged to consult the other volumes in this series when his or her own research encounters these interfaces. For example, the protection of intellectual property that results from the scientific and engineering development of nanotechnology is an important consideration in the structuring of nanotechnology businesses. In many instances, such intellectual

property is the only really valuable asset that an early-stage company has. Other considerations important to the structuring of such businesses are discussed in detail in the companion book on business aspects of nanotechnology by Michael Burke. Among other things, the presentation in that volume places the intellectual property considerations within the broader context of issues that must be faced in successfully developing a nanotechnology business. The volume on education and workforce development by Louis Hornyak also integrates well with these issues by explaining concerns related to ensuring that personnel will be adequately trained to develop such intellectual property and to make real contributions to nanotechnology businesses.

And while the section on regulation in this book includes a discussion of various mechanisms to address environmental concerns, there is relatively little specific discussion of what those concerns are or how to assess their risk realistically. Those topics are instead covered in the companion book by Jo Anne Shatkin on nanotechnology and the environment. A much more realistic understanding of the societal context of the interplay between environmental and nanotechnology issues results from the combination of the books, with the companion book providing information useful in discerning *what* should be done and this book on legal aspects describing mechanisms for *how* it should be accomplished. The same is true with ethical issues, which are discussed in considerable detail in the book in this series by Deb Bennett-Woods. That book provides a framework by which ethical issues raised by nanotechnology can be understood and evaluated. This book on legal issues describes a number of mechanisms that may give rise to solutions to those ethical problems.

It is also worth noting that the discussion provided in this book is in a certain sense static. While legal principles have developed a certain flexibility to account for the persistence of change, they seem at any given moment to be relatively fixed. But nanotechnology remains in its infancy and is certain to mature in ways that will challenge the legal framework as it exists today. Aspects of what principles will govern how nanotechnology will evolve over time are developed in the book on the future of nanotechnology by Thomas J. Frey. In many ways, an accurate understanding of these principles may aid in the refinement of laws as they exist today.

One of the goals of representative systems of government, regardless of the details of their specific structure, is to provide a mechanism that allows for coherent decisions to be made in a collective fashion. In such systems, the views of one individual or group are of almost no consequence unless they have the power to persuade others. And the process of attempting to persuade others of the legitimacy of a certain point of view naturally accounts for the concerns of contrary views. In this way, societies aspire to act in a way that is more responsible, more informed, and more ethical than is the sum of its individual parts. In a similar manner—albeit on a much smaller scale—it is hoped that this book will contribute to the Perspectives in Nanotechnology

series in a way that permits greater insight into how legal issues bear on nanotechnology than would be possible with a volume divorced from that wider context.

Note

1. *Washington Post*, "Nanotech Product Recalled in Germany," April 6, 2006, p. A02. Later investigations confirmed that despite the name of the product, Magic Nano did not actually contain nanoparticles.

I

Protection

A. Patents

1. Introduction

Filippo Brunelleschi is best known for his astonishing design of the dome of Santa Maria del Fiore Cathedral in the heart of Florence (Figure I.1). Built primarily between the twelfth and fourteenth centuries, the dome held the record as the largest dome in the world until 1928 when construction of the Leipzig Market dome was completed; the record was thus only passed with the development of a completely new technology, in this case the use of reinforced concrete instead of traditional masonry techniques for building domes. Even now the dome of Santa Maria del Fiore remains larger than the dome of the Capitol Building in Washington DC, larger than the dome at St Paul's Cathedral in London, larger than the dome in the Pantheon in Rome, and even larger than the dome in St. Peter's Basilica in the Vatican. The story of how the dome was built, especially within the context of Brunelleschi's nearly lifelong competition with Lorenzo Ghiberti, is a remarkable story that highlights the achievements possible by those possessed with unusual ingenuity.[1]

What is somewhat less well known about Brunelleschi is that he was also the first person in history to be awarded a patent for a technical invention. Brunelleschi had developed a technique for transporting marble upstream the Arno River to Florence from the quarries at Carrara. During the height of the Italian Renaissance period, the transportation of marble for use in creating sculptural works of art was both difficult and costly. Brunelleschi refused to disclose his technique, fearing that others would make use of his insight without him receiving any direct benefit. The Republic of Florence accordingly granted a patent to Brunelleschi in 1421, giving him a monopoly on the manufacture of his invention, a barge that included hoisting gear to facilitate transportation of the marble. The monopoly lasted three years and permitted Brunelleschi to benefit from inventing what his contemporaries described as "*Il Badalone*" ("The Monster").

In its grant of the patent to Brunelleschi, the Florentine Republic included a preamble that expressed the basic pact that governments continue to make with inventors in order to have them disclose their inventions:

FIGURE I.1
A view of Santa Maria del Fiore Cathedral showing the design of Brunelleschi's dome.

> The admirable Filippo Brunelleschi, a man of the most perspicacious intellect, industry and invention, citizen of Florence, has invented some machine or kind of ship, by means of which he thinks he can easily, at any time, bring in any merchandise and load on the river Arno and on any other river or water, for less money than usual, and with several other benefits to merchants…. [H]e refuses to make such machine available to the public, in order that the fruit of his genius and skill may not be reaped by another without his will and consent…. [I]f he enjoyed some prerogative concerning this, he would open up what he is hiding and would disclose it to all.

Since the time of Brunelleschi, virtually every government has adopted some form of patent system, in which the government grants an inventor certain benefits in exchange for the public disclosure of his or her invention. Almost always, these benefits take the form of rights backed by the legal authority of the state that permit the inventor to control use of the invention.

i. Monopoly Powers

This basic agreement between inventors and governments remains at the heart of all patent systems to this day. By inducing inventors to disclose their inventions, governments increase the baseline of public knowledge, enabling other inventors to improve on those inventions in ways that were not conceived of by the original inventor. In this way, the system continually accelerates the pace of innovation by progressively making innovations accessible to as many people as possible.

Ever since the creation of patent systems, the monopoly powers that have been granted to inventors have, at the same time, caused consternation among those who wish to use the inventions. This is particularly true when the monopoly is being exercised at a time further removed from the original invention. When a useful invention is first disclosed, people are generally willing to acknowledge the creativity it represents and to concede that the inventor is entitled to some reward for having conceived of such a useful idea and publicly shared it. But over time, the invention becomes well known and common, and this initial perspective becomes eroded. People begin to bemoan the fact that, rather than spur their own innovation, the monopoly power is acting to prevent them from building on the original invention because they must secure the inventor's permission to be able to use it.

This pattern has always existed and is very much present today as these same kinds of criticisms continue to be made. In some cases, the criticisms (of the past or present) may be valid, with the monopoly power granted to the inventor being too strong or persisting for too great a time. And what was an effective compromise to achieve the goals of spurring innovation in the fifteenth century may prove not to be the best compromise in later centuries—the technologies themselves are different, as reflected in the way innovations are made; the context of technology in society as a whole is different; and certain technologies may be viewed as so fundamental to basic human existence that monopolies on those technologies are viewed with public suspicion or distaste.

For this reason, governments continually reconsider the specifics of the patent system. They modify the definition of what types of technology may be patentable, and different governments frequently develop different answers. This is perhaps most evident in the different approaches taken with health-related inventions. Countries like those in Europe have concluded that methods of treating living bodies are so fundamental to human health that patents covering them are disallowed; countries like the United States have instead determined that there is a very real risk that such methods will be suppressed and concealed by inventors if they are not rewarded for disclosure, and so still accept the basic patent compromise. Some countries perform a similar accounting to conclude that laboratory-created organisms should not be patented, while others reach the opposite conclusion.

Is society better off by allowing Philip Leder to patent the oncomouse? Leder and his colleagues at Harvard University developed a biotech process

in the early 1980s to create a species of mouse that was genetically engineered to be susceptible to cancers, hence its christening as the "*oncomouse*." The benefit to human beings is clear in that the oncomouse provides a biological model on which much valuable research has been conducted, leading to a better understanding of cancer. This understanding may have been achieved countless years or decades earlier than might have been needed without the oncomouse, resulting in untold numbers of human lives being saved from a horrific disease. At the same time, what many find to be horrifying is the assertion of monopolistic control over life-forms.

Irrespective of the specific rights that governments grant to inventors, the basic bargain remains at the heart of all patent systems: the invention is disclosed to the public in exchange for some government-backed right. The preamble to Brunelleschi's patent also highlights the basic nature of this right, which is a form of monopoly right that permits the inventor to prevent others from using the invention—as the preamble poetically explains, the fruit of the inventor's genius and skill may not be reaped by another without his will and consent.

The basic nature of this right is sometimes misunderstood. A common belief is that a patent assures the inventor of an unfettered right to produce, market, and sell the invention—in the parlance of patent law, the right to "practice the invention." This is, in fact, completely untrue. What patent rights grant is the ability to *prevent others* from engaging in those kinds of activities. As a result, many patent holders may be prevented from using even their own inventions without permission from other patent holders.

ii. Licensing Arrangements

This may be illustrated using a simplified example involving nanotechnology products. Without considering a variety of technical issues that might be raised concerning their patentability, suppose that when fullerene structures were first developed a patent application was filed and granted to Inventor A and covered all types of fullerenes. Later, nanotubes were developed by Inventor B and are broadly considered to be fullerene structures falling within the scope of coverage of that first patent. Because he holds the basic fullerene patent, Inventor A is entitled to prevent Inventor B from making and selling his fullerene nanotubes. But Inventor B is still entitled to file for her own patent on this improvement in technology and may be granted a patent that covers nanotubes. Indeed, the intent of the patent system is to publicize Inventor A's development of fullerenes so that others, like Inventor B, will have access to the information and be in a position to invent improvements on it.

This process may continue. After Inventor B's patent issues, yet another person, Inventor C, may dope the nanotube structures with certain materials that cause the structure to become superconducting. This represents still a further improvement in technology that was accelerated by the incentive for

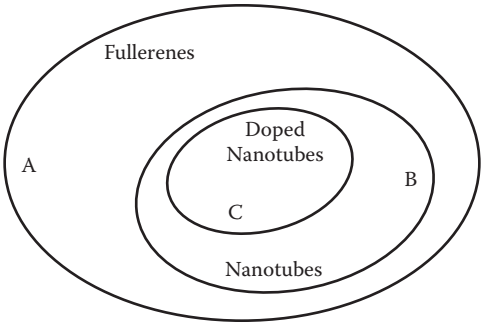

FIGURE I.2
The patents issued to A, B, and C are of progressively narrower scope. Because A's patent covers all fullerenes, B and C both need a license from A. Because B's patent covers all nanotubes, C additionally needs a license from B.

disclosure that the patent system provides. Inventor C may accordingly file for and be granted a patent that covers doped nanotubes.

The three patents that have now issued cover progressively narrower aspects of technology, but the narrower patents tend to cover technology that is more commercially useful. Consider the situations in which Inventors A, B, and C now find themselves. Inventor C, even though he holds a patent on the very valuable doped nanotube structures, may nonetheless be prevented from making and selling them because he infringes the patents held by Inventors A and B. He infringes the patent held by Inventor B because his doped nanotubes are still nanotube structures that are covered by the second patent. And he infringes the patent held by Inventor A because his doped nanotubes are also fullerenes that are covered by the first patent. For Inventor C to be able to make and sell these structures, he must obtain permission from both Inventors A and B, usually in the form of a license (see Figure I.2).

Inventor B faces a similar difficulty. Even though she holds a patent on nanotube structures, she infringes Inventor A's patent. Inventor B may be prevented by Inventor A from fabricating her nanotube structures because they are a type of fullerene covered by the first patent.

At first glance, it may appear that Inventor A is in the catbird seat. In many respects he is, for he owns the fundamental patent for a line of technology that has begun to develop and that has attracted public interest. Anyone who wishes to fabricate fullerenes will have to deal with him in some fashion, and he may be rewarded financially by selling licenses to his patent to Inventors B and C, and to anyone else who might want to participate in commercializing this line of technology. This is how it should be. Inventor A made a fundamental discovery that has spawned a whole new line of valuable technology. The patent system has put him in the position of being able to reap a significant financial reward in exchange for having disclosed his invention publicly and permitting others to improve on it.