

HOW TO INVENT AND PROTECT YOUR INVENTION

HOW TO INVENT AND PROTECT YOUR INVENTION

A Guide to Patents for
Scientists and Engineers

JOSEPH P. KENNEDY and WAYNE H. WATKINS
with **ELYSE N. BALL**

 **WILEY**

A JOHN WILEY & SONS, INC., PUBLICATION

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Published by John Wiley & Sons, Inc., Hoboken, New Jersey
Published simultaneously in Canada

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Hand-drawn original illustrations by Mark Murphy.

Library of Congress Cataloging-in-Publication Data is available.

ISBN 978-1-118-36937-1

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1

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PREFACE: HOW THIS BOOK CAME TO BE AND FOR WHOM IT IS WRITTEN

This book is mainly for graduate students in the sciences and engineering, but can be of use to educators, non-patent attorneys, and business people.

Joseph P. Kennedy. I am an industrial scientist/researcher transplanted to academia (a re-tread we would say in Akron). After 13 years in the polymer and petrochemical industries I came to The University of Akron, where I have been teaching and doing research for the last 40 years. I decided to join academia not because I didn't make it in industry but because I wanted to do my thing my own way. I loved industrial research and was a little sad when I came to the conclusion that the time had come to change.

When I got to the university, I knew pretty well what kind of research I wanted to do but hadn't made up my mind about the courses I wanted to teach. Because it was easy for me I decided to give a course on "Cationic Polymerizations," a field I knew and wanted to do research in. Thus, I created a course, and the students who took it seemed interested. I noticed that the most animated questioning always arose during the presentation of industry-oriented material.

This was an eye opener and led me to the idea of writing a course of things industrial for budding mission-directed scientists on the threshold of leaving our program and entering the industrial market. To justify my course, I had to know how many of our students actually went to industry, who exactly were our industry "clients," and what our clients really wanted and needed. A little surveying revealed that, by far, most of our Ph.D. and M.S. graduates went to industry, and only a few went to government and academia.

The next questions were obvious: What are we doing for our clients? Are we producing the product they want? Or are we producing young professionals that *we* want, or we think *they* want? I remembered that when I, then a post-doc, sold my soul for better pay to industry and switched to an industrial research job, I hadn't the foggiest idea about my new job. I thought I would be doing polymer research and was very proud of the little knowledge I had. I learned awfully fast that *the technical part was the easy part of my job*. I learned rapidly that the cost of a material and not its molecular weight or melting point is its most important property; that patenting, marketing, accounting, sales, and so on, exist; and that people in these functions are just as important, if not more important, to the company as I, the bench chemist, was. I suddenly realized and still feel strongly that *when the young graduate student in the sciences starts his career in industry he is overeducated in technical matters in his specialty and undereducated in other things that are just as important to his career*. The young polymer scientist soon finds that his group leader is not much interested in his Ph.D. thesis or in elegant syntheses, but more in his ability to demonstrate how to make cheaply a faster-curing rubber, a better sticking glue, and so on.

It can be readily demonstrated that while fully two-thirds of students graduating with advanced degrees in chemistry go on to work in the private sector (most to the chemical industry), these youngsters are almost without exception badly prepared for what they are really to do. The young graduate is usually excellently qualified to carry out research; however, he has little understanding of the nontechnical—that is, business, legal, intellectual property, economic, and societal—aspects of his profession. It is here that graduate curricula are singularly lacking.

A Ph.D. degree should indicate that the holder is qualified to define and carry out an independent research project. It does not mean he is an expert in polymer chemistry, except perhaps in the narrow field of his thesis research. But the young polymer scientist is seldom hired for his expertise in his thesis area; the chance that he will work in this field in industry is remote. Few companies hire young Ph.D.s because they need such expertise, and even companies who do will expect the young professional to adapt and change when the project is terminated. *Industry hires Ph.D.s not because they need specific expertise but because it surmises that Ph.D.s are the best academia has to offer.*

Graduate departments are much too oriented to producing good research professors and too little oriented to producing good industrial professionals. It is my observation, and many of my friends in industry share my belief, that it takes two to five years after first joining a company for a young chemist to make a worthwhile contribution toward the objectives of his organization. The university must try to shorten this induction period, this incredibly high-risk investment. (To me research in an investment and not a cost.)

At present, *career* education in polymer science and chemistry consists mainly of advice, both formal and informal, on the part of the faculty. Faculty advice seems to run the spectrum from well-informed and open-minded to downright uninformed or biased. And career counseling has to be solicited by the students; the student has to feel the need for advice and take the initiative in seeking it. The student cannot get the best job in industry when he doesn't even know what to look for. Trying to find out about career requirements before a student gets a degree is too late. Faculty have an obligation to help the student not only with research but also by widening his horizons and broadening his interest. I felt the need to design a career-oriented course for graduate students in the sciences and engineering headed for industry. The student should not only be exposed to technical specialties but should be made aware of nontechnical career options of his chosen profession.

With these thoughts in mind, I wrote the course "The Professional Scientist and Engineer in Industry," which I taught here at The University of Akron with gratifying response. The course is for graduate students or for undergraduate seniors with permission.

The course starts with a broad examination of research and development in the chemical, including polymer, industry. We examine the types of jobs available in the chemical and allied industries and we talk about the roles of support people. We ask: What are young inexperienced Ph.D.'s good for? What can they do? What are the chances that they will be doing the kind of research they were trained for?

The next area we tackle is the difference between academic and industrial jobs. And this is a meaty subject. One way of presenting this dichotomy is shown in Table P.1.

Then we discuss the *raison d'être* of industrial research and development: to create investment opportunities by inventing and innovating. In this manner, we reach our starting point for examination: intellectual property and the patent system from the vantage point of the professional scientist and engineer. *To me, the fact that teaching the fundamentals of patents is ignored in the graduate curriculum is incomprehensible and simply indefensible.* While almost all chemists and polymer scientists in industry are involved with potentially patentable work, American graduate students are underexposed to and unprepared for this all-important field. They are unaware of the importance of U.S. Patent Law and patent practices in shaping their daily industrial existence and future. *A measure of understanding and appreciation of U.S. Patent Law by every graduate student in the sciences and engineering would be an asset, but ignorance of this law by an industrial employee is intolerable.*

When we talk about this, I reminisce about my first in-flesh encounter with a patent lawyer. First, we didn't quite understand each other. After we started to communicate—sort of—I realized that I was at a terrible disadvantage and

TABLE P.1. Job Differences Between Industry and Universities

Job Aspect	Industry	University
<i>Continuity</i>	Low	High
<i>Flexibility</i>	High	Low
<i>Technical content during professional career</i>	Changes	Constant
<i>Job security</i>	Low, reflects environment	High
<i>Interfaces, contacts</i>	Various levels and disciplines	Peers, usually in same discipline
<i>Accountability</i>	High and constant	Low
<i>Public relations (personality)</i>	Important	Less important
<i>Progression</i>	Varied, sinusoidal	Steady, linear
<i>Knowledge requirement</i>	Broad, general	Narrow, specialized
<i>Direction</i>	To exploit knowledge	To generate knowledge
<i>Target</i>	To complete specific missions	To generate knowledge
<i>Communication, written</i>	Patents, reports, articles	Journal publications
<i>Communication, oral</i>	Peers, managers, support people	Scientific peers, students

felt terribly ill at ease. This young patent lawyer, with his limited understanding of the chemistry of my case (the hydride migration polymerization of 3-methyl-1-butene to the first crystalline poly- α -olefin by cationic technique), proceeded to explain to me what I had *really* invented. He expressed dismay that I did not know when conception occurred and when reduction to practice took place, and he asked me why I hadn't been concerned with "utility." He did say that I was "diligent," but only later did I learn that this was not his way of approving my activities. I felt awfully deflated. I hope I can spare my students such ordeals.

I relate to the class another unpleasant episode that occurred at the start of my industrial career and could have been easily avoided had I known the elements of U.S. Patent Law. In my first job, my group leader told me to produce a polyacrylonitrile (PAN) fiber, which he had found could be made by a new catalyst. My job was to characterize this PAN. After considerable work I was able to show that the thermal properties of this PAN were somewhat better than those of "conventional" PAN. However, I was terribly disappointed to learn that my name would not appear on the patent as I was not an inventor. It would have been on a journal paper. I was particularly upset because without my contribution there could not have been a patent application.

I thought that the patent attorney and my group leader's explanation having to do with "conception" and "reduction to practice" was unjust and that they were in cahoots against me. I thought I was duped and considered returning to academia among gentlemen. Again, I think I can spare my students from situations like this.

I am convinced that spending a few hours on patent matters is one of the best investments a graduate student in the sciences and engineering can make.

And thus, this book came about.

Wayne H. Watkins. My career has focused on identifying, assessing, and commercializing innovations to achieve economic benefit and to improve overall quality of living. It has been a privilege to serve and associate with gifted scientists and engineers, business experts, capital providers, and community leaders who collectively have created technology, processes, and products that make your life and my life better.

Although he objects to my singling him out, my co-author, Dr. Joseph P. Kennedy, is the named inventor on more than 100 patents and well exemplifies creative genius and capacity to innovate. Researching, inventing, identifying quality ideas, assessing their commercial potential, and then developing and implementing plans for commercial development constitute the components of a most rewarding career. I am honored to be a participant in this remarkable process.

My interests in innovation were influenced by association with brilliant innovators including my father, Reynold K. Watkins, a civil engineering professor who was (and is at age 92 in 2012) always connecting his profession to the communities he serves. Dad would often share with his impressionable son the stories of his own innovations, as well as those of others that he championed. One inventor constantly approached Dad on new engine designs. Dad described his friend as an "irascible inventor," a phrase I have thought of often as I have come to love and understand the passion and tenacity of inventors. Dad was instrumental in designing the original track master snow vehicle for the purpose of helping his Utah State University colleagues measure snow-pack in the Rocky Mountains as they developed models for managing water resources in the arid west. At the request of LaDell Anderson, a university and professional basketball coach, Dad as a professor and "public servant" designed the adjustable height basketball hoop, based on a parallelogram configuration which is now found on driveways throughout America. Dad's payment for the invention services was a basketball hoop that I used as a youth. Dad, a geotechnical engineer, designed a soil bridge arch, using the concept of a keystone arch with the "keystone" consisting of a bin with compacted soil, thus allowing for long-span flexible culverts. I am grateful for such an upbringing.

I completed an engineering degree along with a law degree and an MBA degree. The result was a freshly minted graduate with little real-world savvy, but with enough understanding of the essential roles of science, business, and law in creating wealth and commercializing innovations.

I became the original administrator of a private innovation center spun out of the University of Utah. I supported relatively well-to-do individuals in managing their assets, including acquiring companies. I started a university research park and technology transfer program. I became a principal in several technology-focused enterprises. I have participated in creating model university-industry programs. I am a past president of the University Economic Development Association. I enjoy teaching intellectual property management. I am grateful for the opportunity to co-author this book with Dr. Joseph P. Kennedy, an innovator “par excellence”, and with Elyse Ball, a talented and gifted writer and a valued colleague.

Elyse N. Ball. Less than a decade ago, I was a recent graduate of Ohio University’s E.W. Scripps School of Journalism and had moved back home to find a job in my chosen field or any other field that would take me. In between periods of job hunting and wondering whether getting a degree in journalism was such a good idea after all, I attended the graduation party of a family friend, Tanner Watkins. Naturally, Tanner’s father (and my current co-author) Wayne was at the party and, after I had explained my predicament, he told me there was an opening at the University of Akron Research Foundation.

Wayne has a habit of carrying around index cards in his jacket pocket, so that he can jot down notes on anything important that comes up. Over the course of writing this book, he has probably run through 100 notecards, keeping track of all the ideas that come out of our weekly book meetings. But on this occasion, Wayne put together an index card for me. On it, he had written about eight phrases, like “intellectual property management,” “technology licensing” and “joint venture.” He encouraged me to familiarize myself with these terms if I wanted to apply for the job at the Research Foundation.

I would love to say that I still have this card and that it is framed and hanging in my office. But I haven’t seen it in years and assume that it was thrown out during some bout of bedroom cleaning when I found it in the bottom of my desk drawer or under a pile of sweaters in my closet. I think it probably wound up in one of those locations because I remember taking it home and hiding it. As a recent college graduate, I had no idea what to do when confronted with a half dozen phrases I didn’t understand. In fact, if I hadn’t known Wayne so well, I probably would have suspected this was some kind of cruel practical joke.

I did eventually get over my fear of those unfamiliar phrases. I dug the index card back out, Googled every phrase, interviewed for a job for which I was grossly underqualified, and was hired by the Research Foundation a month later. I learned more during my time at the Research Foundation than I have learned in any other job or in any number of years of schooling. I had the opportunity to work with dozens of brilliant professors seeking to commercialize their inventions and with equally brilliant lawyers, scientists, business people, and accountants who help these inventors in that quest. I've learned more than I ever thought I would about starting a company and the challenges these technology-based start-ups face. I also decided to attend law school and subsequently graduated from Boston University's School of Law. Last year, I returned to Akron to start my legal career.

The more I have learned about intellectual property law, the more I have come to understand its importance and enjoy being a part of the field. I think that many scientists, business people, and even lawyers view intellectual property law and patents as being about what someone can't do. You can't make, use, or sell a patented invention. And you can't print, copy, or distribute a copyrighted book. But more than anything, I have been drawn to intellectual property law because of what you can do. Hard-working university researchers can make money from the products of their research by patenting and then licensing their inventions. A small business owner can challenge established companies on the free market because they can prevent these industry giants from stealing their invention. And a region, like Akron, can create jobs by investing in the kind of activities that lead to patentable invention and by funneling these patents to companies that are poised to commercialize them. But I also understand that intellectual property law lacks any purpose without scientists and engineers to make the inventions that patent law so fiercely protects.

It has been a great honor to co-author this book, in part because I get to work with two people that I admire greatly and in part because it is incredibly important to help those who invent understand the legal aspects of protecting their inventions. My hope is that readers of this book will master the basics of patent law, gain an appreciation of the role that patents play in turning inventions into socially beneficial products, and learn at least half a dozen phrases that they can write on index cards to intimidate recent graduates. All of this is to say that most people, even future lawyers, at one point found patent law baffling and intimidating. After all, I still vividly remember hiding a list of patent-related terms in the bottom of a desk drawer.

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WAYNE H. WATKINS
ELYSE N. BALL

ACKNOWLEDGMENTS

This book is the result of Cynthia Rose's insistence and Ingrid Kennedy's nudging that their father and husband respectively, Dr. Joseph P. Kennedy, capture in writing the essence of his experiences teaching a graduate-level course on intellectual property for over 20 years. The course was designed to teach science and engineering students how to invent and how to protect an invention, as well as how to improve the human condition through science related inventing and patenting. Cynthia Rose also originated the concept for the cover of this book.

The authors are most grateful to the significant contributions of Susan E. Dollinger and Dr. Rex W. Watkins. Susan is a valued colleague at The University of Akron and has been instrumental in supporting Dr. Kennedy's innovation activities. She requested that Dr. Kennedy include his experience and perspective on inventing in the book, which you will find as Chapter 3. Rex, with his perspective as a recent Ph.D. student in biochemistry and now as a patent agent and soon to be patent attorney, provided important and appreciated comments and edits.

Others to whom the authors are indebted and most grateful for their assistance include Justin Ball, Aimee DeChambeau, Bernard Schneier, and Loreley Woody, who each reviewed and commented on various portions of the book. The authors also acknowledge Mark Murphy, whose original hand-drawn illustrations greatly add to this book.

Finally, the authors would like to thank their families for their love, support, encouragement, editing prowess, and willingness to put up with working weekends and late nights while this project was in progress.

J. P. K.
W. H. W.
E. N. B.

ABBREVIATIONS

CCPA	Court of Customs and Patent Appeals
CAFC	Court of Appeals of the Federal Circuit
CIP	Continuation-in-Part
EPO	European Patent Office
FDA	Federal Drug Administration
he	he or she
him	him or her
himself	himself or herself
NPR	non-publication request
MPEP	Manual of Patent Examining Procedures
NDA	non-disclosure agreement
NSF	National Science Foundation
PCT	Patent Cooperation Treaty
PHOSITA	Person having ordinary skill in the art
PRP	Patent Rules of Practice
PTAB	Patent Trial and Appeal Board
PTO	U.S. Patent and Trademark Office
TRIPS	Agreement on Trade Related Aspects of Intellectual Property Rights
U.S.C. 35	Title 35 of the U.S. Code, the Patent Law
WIPO	World Intellectual Property Organization

The
United
States
of
America



The Commissioner of
Patents and Trademarks

Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this \$3,860,492

United States Patent

Grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America for the term set forth below, subject to the payment of maintenance fees as provided by law.

If this application was filed prior to June 8, 1995, the term of this patent is the longer of seventeen years from the date of grant of this patent or twenty years from the earliest effective U.S. filing date of the application, subject to any statutory extension.

If this application was filed on or after June 8, 1995, the term of this patent is twenty years from the U.S. filing date, subject to any statutory extension. If the application contains a specific reference to an earlier filed application or applications under 35 U.S.C. 120, 121 or 365(c), the term of the patent is twenty years from the date on which the earliest application was filed, subject to any statutory extension.

J. Todd Johnson

Acting Commissioner of Patents and Trademarks

Marjorie V. Turner

Attest

FIGURE 1.1. The facsimile of a U.S. patent.

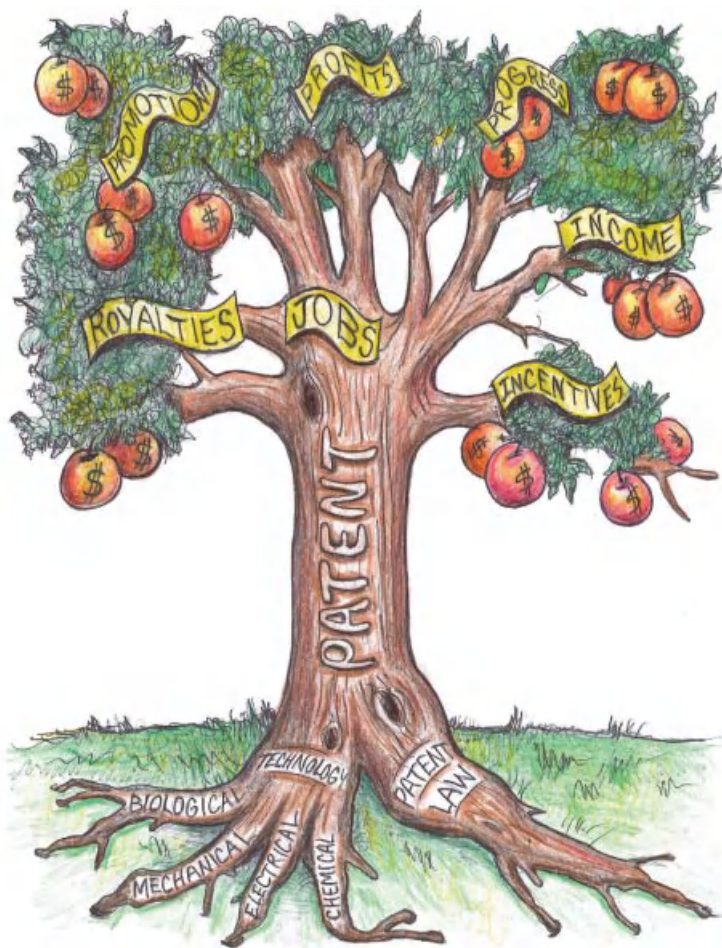


FIGURE 14.4. The patent tree: The patent unites technology and legal principles to produce numerous societal benefits.

CHAPTER 1

THE U.S. PATENT SYSTEM

1.1. WHAT IS A PATENT?

Let us start with the U.S. Patent Office's definition of a patent:

A patent for an invention is the grant of a property right to the inventor, issued by the United States Patent and Trademark Office. Generally, the term of a new patent is 20 years from the date on which the application for the patent was filed in the United States. . . . U.S. patent grants are effective only within the United States, U.S. territories, and U.S. possessions.

The right conferred by the patent grant is . . . the right to exclude others from making, using, offering for sale, or selling the invention in the United States or importing the invention into the United States. What is granted is not the right to make, use, offer for sale, sell or import, but the right to exclude others from making, using, offering for sale, selling or importing the invention.

A patent is essentially a bargain or agreement, between the inventor and the government. The essence of the agreement is that the inventor discloses his secret (invention) to the public and the federal government authorizes him

How to Invent and Protect Your Invention: A Guide to Patents for Scientists and Engineers, First Edition. Joseph P. Kennedy and Wayne H. Watkins with Elyse N. Ball.
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to stop others from exploiting the invention for a limited time. The rationale for this agreement is that scientific progress is promoted by providing a strong incentive to both invent and disclose one's invention. This is accomplished by the government's guarantee to the inventor (or his designated commercialization partners) of the right to limit others from making, using, or selling the invention for the life of the patent. The end result is that the inventor has a better chance to derive a profit from the invention. This is distinguished from an inventor having a guarantee that she will profit from the invention, a guarantee that is not provided by a patent.

This equivalence can be expressed by the equation

$$P = I + D + F$$

where P is patent protection, I is invention, D is public disclosure of the invention, and F represents fees to the government. A patent provides increased opportunity for its owner to receive a financial return from the invention by granting a right to limit others from exploiting the invention.

The patent system exists to encourage individuals to divulge secret ideas that will promote scientific progress. Unlike physical goods (tangible assets), ideas (intangible assets) can theoretically be reproduced an infinite number of times at no cost, which means that even if one person has the idea, all other people could conceivably have it as well. For example, if one person gives a dollar bill to another, the second person is one dollar richer, while the first is one dollar poorer. However, if one person gives an idea to another, the second person is one idea richer, but the first person is not any poorer.

Unlike ideas, physical possessions are limited by the material used and the human or machine effort needed to make the items. When one expends intellectual energy, physical hard work, or financial resources to obtain a physical possession, like a home or a flat screen TV, he alone is the owner of that item. He can exclude others from using his home or TV based on personal property laws. Intellectual property, such as an idea about an invention that can be made or a process for manufacturing, is similar in that one can limit (by law) another's use, but is dissimilar as it is not limited by physical material or equipment and labor to manufacture. If an inventor puts intellectual energy, hard work, and physical resources into developing a new idea, he has no means (aside from patent law) to prevent others from making his product or using his process, after it has been used or disclosed. Thus, the inventor's instinct is to protect his idea by hiding it from others. He will attempt to prevent others from knowing how he made the product or how his process works. In such a situation, secretively protecting one's invention is perfectly logical. However, if the product or process is kept secret, anyone who wants to make the same product or use the same process must develop it on his

own. In some cases, this could be done through careful observation or reverse engineering. But regardless of the means of obtaining this knowledge, others must expend additional effort and energy to gain possession of knowledge that is already in existence.

Patent rights circumvent this wasteful process of inventing, keeping one's invention secret and forcing others to expend energy "inventing" something that has, in fact, already been invented. Patent law is just one form of intellectual property, along with copyright, trademark, and many others.

As stated by U.S. law, the goal of patents is purely utilitarian: having people share the secrets of their inventive ideas in exchange for the right to prevent others from copying or using their invention for a limited time. Put another way, patent law encourages inventors to divulge a secret in exchange for short-term "exclusivity" to use their invention. Of course, there are other results of patent law, such as financially rewarding inventive activity, giving inventors recognition for their accomplishments and giving inventors control over the product of their hard work. These considerations are secondary and are not explicitly recognized by the authorizing U.S. law for patents.

Patents and inventions should not be confused. For example, an inventor owns a patent for a product. When the inventor sells his invention, he is selling the physical product, not the idea behind it. When the inventor sells the patent, he sells the right to make the invention or to use his idea. The invention can be great; but if the patent is poorly written (constructed), it will be of little value. However, if a patent is broadly constructed, even a mediocre invention can become a valuable patent.

A patent is evidenced by a legal document, the issued letters patent, usually written by a patent attorney who by definition has both technical and legal training. The patent attorney is generally skilled in communicating technical matters in an appropriate manner to meet legal requirements and to ensure technical precision. The patent attorney, with the help of the inventor, translates the results of scientific and/or engineering research into legally enforceable property. The words of the patent adequately and precisely define the property rights claimed. At times, patent attorneys are accused of writing in *legalese*. Patent writing can be perceived by an inventor as being peculiar. Inventors and attorneys need to exercise extra care in ensuring effective communication. Communicating across multiple cultures and disciplines, such as law and science or business and science, can be a daunting task. Those who do it well increase their career potential.

Patents contain specifications that teach, along with claims that define that which is novel, useful, and unobvious and thus what one is prohibited from using without authorization. Specifications teach others how to make or use the invention, whereas claims prohibit them from making, using, or selling

the invention. These words and concepts will be explained in greater detail in later chapters.

Physically, a patent is printed in an impressive document adorned by a gold seal, a red ribbon, and signatures and is given to the owner of the patent for safe keeping (Figure 1.1). Time will tell whether this document is worth millions of dollars and will revolutionize an industry, or a worthless sheet of paper collecting dust on a shelf.



FIGURE 1.1. The facsimile of a U.S. patent. Please see color insert.

1.2. WHY SHOULD YOU FILE A PATENT?

A patent gives an inventor control over the use of his invention. The owner of the patent has the *right to exclude others* from profiting from the invention. In other words, the patent is a *negative right*, a right to stop others from making, selling, using, or importing a product or service that is based on the invention. In contrast, a *positive right* gives one the affirmative ability to take an action; for example, patent holders have the positive right to sue those that infringe their patents. It is important to understand that the granting of a patent does not give the patent holder the right to make, use, sell, or import the thing he invented, nor does it guarantee that the inventor is free and clear to do those things. A patent holder may be blocked from making products from his invention because the invention is based in part on another's patent (often referred to as a blocking or dominating patent) that she does not have authorization to make or use. In addition, a product may be limited by laws that prohibit the manufacture or use of such a product (certain weapons or illegal drugs) or by administrative regulations that may limit how an invention can be used, such as a new pharmaceutical that is limited in its uses by the Food and Drug Administration (FDA).

Although the patent confers only an exclusionary right, it can be a formidable weapon against an intruder (infringer) who invades the patent holder's domain. A patent gives the inventor the right to sue infringers, those who use the invention without the patent owner's permission. If the infringer is found to have made, used, or sold a product or service that is based on the patented invention, then she will likely have to pay the actual damages the patent owner has incurred to compensate the patent owner for lost value, and may be enjoined (prohibited) from using the invention. Thus a patent allows one to limit the use of an invention to those who are specifically authorized or licensed.

So why is it important to be able to stop others from making, using, selling, or importing an invention? Having the exclusive ability to engage in these activities means that the inventor can successfully limit those who would otherwise try to make money off of his invention and he can charge them for the right to use his invention. Provided that he is not blocked by other patents or regulations, an inventor can also refuse to share his patent rights with others, meaning that (for a short time) he is the only one that can sell products based on his invention. As discussed in Section 1.1, patents protect inventors who want to share their ideas with others by guaranteeing that inventors maintain ownership of the very ideas they want to share. Because a patent can be freely discussed with the public, patent holders have greater ability to promote their new inventions. Patent-holding inventors can advertise their inventions in trade publications, discuss how their inventions work with potential buyers

and licensees, and transfer certain rights to use their inventions with a legally binding contract (i.e., the license agreement). Additional reasons to file a patent application may include discouraging competitors, getting royalty payments from those that make or sell your invention, escaping royalty payments by proving you actually own the invention, and for advertising purposes (such as the ability to use the phrase “patent pending”).

An additional purpose for pursuing a patent is to gain an understanding of a competitor’s latest developments by encouraging the competitor to object to your patent application if they have developed the same. If multiple parties attempt to patent the same invention, the Patent and Trademark Office (PTO) might automatically initiate a “derivation proceeding” to see if one inventor stole the idea for the invention from another, which will bring out more details about the competitor’s invention. Similarly, filing a patent infringement suit can force a competitor to disclose information about his technology.

CHAPTER 2

ORIGINS OF U.S. PATENT LAW

So from where did patents (from the Latin *patere* “to lay open”) originate, and how did the patent system come about?

The answer to these questions is both educational and brings our subject sharply into focus. In the final analysis, we come to the prosaic conclusion that the patent system came about mainly because of humanity’s innate greed and laziness or, as some may say, “enlightened self-interest.” Greed has spawned many achievements in human history. Just think of the accidental discovery of America by Columbus, whose real purpose was to find a shorter, less expensive route than the long and dangerous Silk Road to bring expensive Indian spices to Europe. As this applies to patents, why would a person reveal a valuable secret or allow the copying of what she invented, if not for personal enrichment? Most persons expect substantial benefit to be willing to share a valuable intellectual possession with another person.

And in regard to laziness, most persons strive to discover new materials or new processes to increase their leisure time, avoid work, or improve their quality of life.

This is not to say that inventors are greedy or lazy. In fact, the personal enrichment that inventors attain through invention leads to great fulfillment. Many inventors conduct research to simply have fun, to satisfy natural

curiosity, or to serve others, as well as to get paid for it. Inventions, ranging from farming equipment to new information technology, have greatly increased the efficiency with which we complete work, which means that inventors today have more leisure time than their predecessors. Notwithstanding, many inventors just spend their leisure time doing research and inventing.

2.1. A BRIEF HISTORY OF PATENT LAW

It is rather difficult to pinpoint exactly when and where the patent system originated. We may regard the exclusive rights granted by kings, rulers, municipalities, or guilds to individuals in exchange for their performing some arduous task as the precursor of the patent system. For example, a medieval prince who wanted to have a bridge built over a dangerous river crossing could have said to one of his barons: “If you build us a sturdy bridge across this river at this place, I will grant you the right to collect toll from those who want to use your bridge and I will prevent others from building competing bridges.” In this manner, the baron was satisfied that his bridge-building investment was protected and that he would have a steady stream of income at least as long as the prince was in power.

The first formal patent system may be traced to the medieval city-state of Venice, a powerful trading center during the Renaissance. Venetian patent laws allowed the government to destroy devices competing with those of the inventor, which is basically what happens today when a patent holder wins an infringement suit. In passing their patent law in 1474, the Venetian government declared that granting patent privileges to individuals for their inventions and manufactures would motivate others to emulate the holder of the patent right, leading to even more innovation. *The recognition that patents encourage competition is the basis of all subsequent patent laws*, and we are indeed much indebted to Venice for first codifying this fundamental insight.

The Venetian system spawned the concept of the modern patent. In 1624, the British Parliament passed a law called the “Statute of Monopolies,” which granted monopolies to inventors for 14 years. *This was the first time the law placed a time limitation on protected monopolies.*

From England, the patent system reached the United States. After independence but prior to the U.S. Constitution, most of the individual states had their own patent laws and practices. The Founding Fathers recognized the critical importance of protecting the rights of inventors and creative artists (collectively, the right to intellectual property) and gave Congress the Constitutional power to protect inventions and creative works.

2.2. THE FOUNTAINHEAD: THE CONSTITUTION AND THE U.S. PATENT SYSTEM

It all starts with the Constitution of the United States, one of the greatest documents in human history. In it, the Founding Fathers included three lines that became the foundation of U.S. patent law and helped to transform a newly formed, poor, agricultural country into the richest industrialized nation in the world. Clause 8 of Section 8 of Article 1 of the U.S. Constitution states:

Congress shall have Power . . . To promote the Progress of Science and useful Arts, by securing for limited Times to . . . Inventors the exclusive Right to their . . . Discoveries.

The Patent Act interprets the word “discovery” to mean what we now consider to be “invention.”

Thus, patents are the product of laws passed by Congress, and the overriding purpose of patents is to “promote the Progress of Science and useful Arts” and reward the inventor for this accomplishment. The public good takes precedence over the reward. In fact, the Patent Act’s only stated purpose is to further science and the useful arts for the public good. This fundamental principle, which is the basis of the patent system, has not changed since the Constitution was ratified in 1790 and set the stage the modern patent.

The first, relatively brief (only seven sections) U.S. patent law, titled “Act to Promote Progress of the Useful Arts,” was enacted by Congress in 1790 and signed by President George Washington. That same year, the first patent was issued to Samuel Hopkins for an improved process for making potash. This brief one-paragraph, hand-written patent was signed by President George Washington, Attorney General Edmund Randolph and Secretary of State Thomas Jefferson (see Figure 2.1). Jefferson, a prolific inventor who created a portable printing press and made substantial improvements to the plow, was responsible for the examination of the first U.S. patents. As the first U.S. patent examiner, he personally reviewed every patent application during the first three years of the Patent Office’s existence. He employed university people, notably from the University of Pennsylvania, to help with the examination of applications.

Since 1790, the U.S. patent law has gone through many Darwinian evolutionary steps: In 1793, it was replaced by a new act, which was amended in 1800, then expanded in 1839, amended in 1861, and revised in 1874. In 1925, the Patent Office, originally part of the State Department, was transferred to the Department of Commerce. In 1952, the structure of contemporary patent law was established and codified substantially into its present form: Title 35

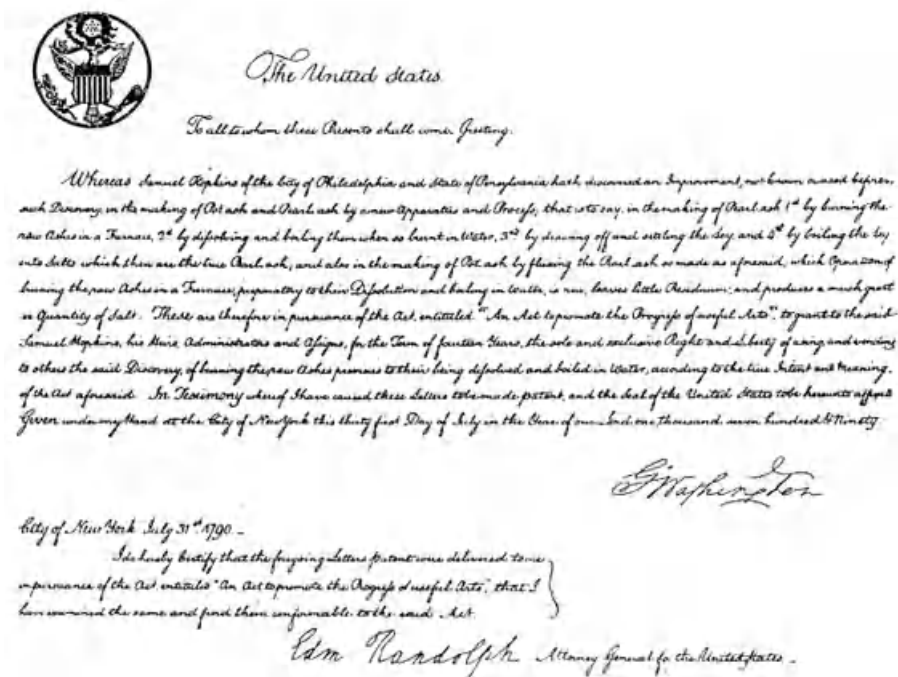


FIGURE 2.1. The first U.S. patent.

of the United States Code. While the 1952 act fundamentally restructured previous patent laws, remarkably, it left the original definition of patentable invention adopted in 1793 essentially unchanged. Since 1952, the Patent Law has undergone a large number of amendments, modifications, and refinements to strengthen the cornerstone of the system: *protection for divulging a secret*.

In 2011, President Obama signed into law the Leahy–Smith America Invents Act, the most sweeping reform of the U.S. patent system since 1952. In perhaps the most important change, the United States shifts to a first-inventor-to-file system (and abandons the first-to-invent system), beginning in 2013. Under the old first-to-invent system, the first inventor to conceive the idea for the invention was entitled to the patent. If multiple patents were filed for the same invention, the inventors had to argue at a costly legal proceeding to determine who came up with the idea first. Under the new first-inventor-to-file system, the first person to file a patent application on an invention is entitled to the patent, unless someone can prove that the first filer actually stole the idea for his invention, rather than inventing it himself. The United States changed its Patent Law to make it more similar to other industrialized nations worldwide, like Japan, China, and most European nations, which all have first-inventor-to-file systems. The America Invents Act also makes other

important changes to the patent system, which are integrated into the book. This book uses only patent rules that are part of the new system, unless we specifically note that we are discussing pre-America Invents Act rules for illustrative purposes.

2.3. ARE PATENTS A MONOPOLY?

You may have heard critics of the patent system deride patents as a government-sanctioned monopoly. A monopoly is the exclusive right of making or selling something in a specified domain, whereas a patent is a grant of rights to limit others' actions for a limited time and applies to inventions not in the public domain. A patent does not take anything from the public that is already available to the public. When someone mentions the word monopoly, you likely think of an individual company dominating the economy in a way that limits consumer options and stifles competition. While patents do grant an exclusive right for a limited time, the patent system does the opposite of a traditional monopoly: It encourages research, investment in new technology, and ultimately competition. After all, no invention can be made without some investment of time and money, and it often takes a substantial amount of money to turn an invention into a saleable product. Few pharmaceutical companies would invest the roughly \$1 billion it takes to bring a new drug to market if another company could simply take their hard work as soon as it is completed. Similarly, few home inventors would publicize their own inventions if a large company could swoop in and start mass-producing the invention without paying a penny. Patent systems worldwide have been carefully calculated to give inventors and investors the incentive they need to develop a useful product and bring it to market, while making sure that these rights are not so broad as to suppress competition and innovation. In fact, the invention and investment encouraged by the patent system actually enhance competition by giving everyone from the small-time independent inventor to the multinational corporation some ownership over their hard and productive work. Thus, a patent would be far more appropriately referred to as a negative monopoly in that it encourages the very type of competition that monopolies are so often accused of stifling.

Although the principle of promoting science for the public good has remained constant for more than 200 years, the patent system is dynamic and in a state of constant evolution.

CHAPTER 3

HOW TO INVENT: INTELLECTUAL ASPECTS OF INVENTING*

This book concerns mostly the legal and business aspects of the inventing and patenting processes, and less so the intellectual–mental aspects of inventing. Writing about the legal aspects of patenting and invention protection was relatively easy and straightforward in contrast, writing about the intellectual aspects and requirements of inventing turned out to be a daunting task, by far the most challenging and difficult chapter to complete.

In spite of what several thinkers (mostly non–patent holders) have written about the inventing process, inventing in my opinion cannot be reduced to a series of successive steps. Inventing is much more than merely following a set of rules; it requires a particular brand of creativity, which I define later in this chapter.

3.1. ON THE DEFINITION OF CREATIVITY

A legally protectable invention (i.e., a patent) is arguably among the most precious products of human creativity. This is particularly true if the invention is a pioneering one that matures into an important innovation and leads to the betterment of the human condition.

*This chapter represents the perspectives and experiences of Dr. Joseph P. Kennedy.

How to Invent and Protect Your Invention: A Guide to Patents for Scientists and Engineers, First Edition. Joseph P. Kennedy and Wayne H. Watkins with Elyse N. Ball.
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But how do we define *creativity*, most often associated with the activity of inventing, to the satisfaction of a scientist or engineer? Webster's definition (creativity = creative ability; artistic or intellectual inventiveness) is not much help.

Creativity is an enormously large and complex subject, the analysis of which keeps hundreds of specialized scholars busy. There are countless books, treatises, scholarly articles, and even journals (e.g., *Creativity Research Journal*, *Journal of Creative Behavior*) on the subject. A query on Google on "What is creativity?" yielded over 130,000 hits. According to Wikipedia, there are over a hundred definitions of creativity and a multitude of theories describing it. No surprise here for the scientist or engineer: Since creativity cannot be measured, it defies definition.

While we cannot define creativity, we know that it exists and we know when we encounter it. The situation is similar to that confronted by United States Supreme Court Justice Potter Stewart who, similarly, found it difficult to define the word "pornography." He eventually abandoned the effort and simply opined: "I know it when I see it."

Surprisingly, none of the many definitions of creativity in the literature (in the prior art, we may say) connect creativity with patenting. There is literature linking creativity and inventing, but nothing that moves beyond inventing, and connects creativity with the specific kind of thinking that results in patentable inventions.

Patentable inventions are one form of creativity, and patents are the result of the creative mind. As discussed in Chapter 5, conception, the starting event of a patent, is another area in which the formulation of a unique idea requires creativity. Thus a patent may be regarded as a measure of creativity; and, indeed, some definitions of creativity are quite similar to those of patents. However, the definition of patents are more specific and restrictive because a patent is a matter of law (see Chapter 5), not the proposition of an author.

3.2. A FLAW IN PATENT LAW

In order to protect (patent) an invention, the invention must conform to Section 101 of Patent Law that defines what is patentable (i.e., the invention must be a useful process, composition of matter, or machine) and must satisfy the first law of inventing:

$$I = U + N + U'$$

where I is invention, U is utility, N is novelty, and U' is unobviousness (more on this in Chapter 5). According to this law, which we choose to call the Law

of Invention Content, an invention must be useful, novel, and unobvious, and these requirements must coexist. Patent Law and patenting procedures established by the U.S. Patent and Trademark Office, as well as court decisions, are well defined and consistent in regard to usefulness and novelty. However, the fundamental requirement of unobviousness, a concept certainly related to creativity, remains ill defined and subject to judicial interpretation even after more than a century.

While patent law never tried to define creativity, it defines unobviousness in terms of the capabilities of a legal fiction, i.e., a person having ordinary skill in the art (a PHOSITA). A PHOSITA is a hypothetical technical person with ordinary common sense who knows all the relevant prior art, but possesses only “ordinary creativity” (as the Supreme Court recently put it in the landmark 2007 decision *KSR Int’l Co. v. Teleflex, Inc.*). The PHOSITA, by definition, cannot conceptualize a patentable invention, but can only conceive technology that a patent examiner would find obvious in light of existing scientific knowledge. (These matters are discussed in detail in Section 4.3) At present, the law simply does not offer a definition or a reliable true standard for patentable inventions, and the dividing line between “ordinary creativity” and the kind of creativity that produces patents has yet to be defined.

3.3. PATENTABLE CREATIVITY

Humans need words to think, and without words we struggle to define a concept. While scientific and artistic creativity may be similar, as many authors on creativity have postulated, for this discussion I searched for a word or expression that would describe specifically the kind of technical creativity that spawns patents. There are many kinds of creativities (artistic, business, political, teaching, advertising, culinary, etc.), but I wish to focus here only on the unique brand of creativity that produces patents. However, despite my sifting through the voluminous literature on creativity (with a professional scientific librarian’s help, I might add), I could not find an appropriate expression that connects creativity and patents.

To resolve this conundrum, I propose the term *patentable creativity* to describe the kind of technological breakthrough creativity that leads to patents. For a working definition I propose: *Patentable creativity is the capacity of the prepared mind to recognize and satisfy a need in a new, useful, and unobvious manner for society’s benefit.* The first part of this definition covers the mental–intellectual input of the inventor, whereas the second half connects it to the requirements of patent law.

Patentable creativity includes the whole spectrum of creativity, starting with truly pioneering patents (e.g. the telephone, airplane, or penicillin) that have profoundly changed society, and ending with incremental or

run-of-the-mill patents (i.e., the vast majority of improvement patents). The classification of a particular patent into one of these categories is a judgment call far beyond the scope of this chapter. Suffice it to state that, by definition, patentable creativity is the kind of creativity that yields patentable inventions.

Having a satisfactory expression and a working definition, we can now proceed to ask: How do we invent, meaning how do we create a patentable invention? And we also ask the corollary to this question: How to do we foster patentable creativity?

3.4. INTELLECTUAL REQUIREMENTS OF INVENTING

After an extensive review of the literature and having examined many case histories on creating and inventing (including the work of Darwin, Crick and Watson, Ziegler and Natta, Staudinger, Carothers, Flory, Debye, H. C. Brown, Olah, Szwarc, and others, several of whom I knew personally quite well and have discussed their work in person), and after having analyzed the processes of how I derived my own inventions, I dare to posit that patentable creativity is *not* the result of some indefinable mysterious intuitive mental process or flash of genius as many authors who wrote about inventing maintain, but simply the result of keen observation by the prepared mind that recognizes a worthy need and proceeds to satisfy it. What is needed is broad and deep scientific or engineering knowledge in a technical field, logical reasoning, and experience, *plus* a modicum of legal knowledge of the few principles of intellectual property law presented in Chapter 5.

We might summarize this thought by the following equation, which is meant to illustrate the set of elements needed to produce a patentable invention:

$$I_p = K_{s/e} + E_t + L_d + P_l$$

where I_p is the patentable invention (in fact, patent), $K_{s/e}$ is scientific/engineering knowledge, E_t is technical experience, L_d is deductive logic, and P_l is patent law. This equation is further illustrated by the Venn diagram in Figure 3.1. The large circle embraces the requirements contributed by the scientist or engineer, while the small circle shows the legal requirement that must also be present for patentable invention.

In the armamentarium of the inventor must be knowledge and experience in a technical field, coupled with the capacity to hypothesize and follow up by experiment to test a hypothesis. No need to be a genius: Ordinary common-sense thinking in which one thought leads logically to the next will lead to patentable invention. We cannot create something from nothing, from the void. Just as matter and energy cannot spontaneously arise from nothing, an idea cannot

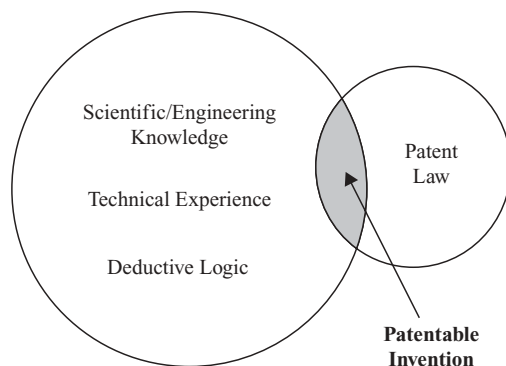


FIGURE 3.1. The requirements for a patentable invention.

arise from nothing either. The precursor of an idea is an earlier idea based upon accumulated knowledge and experience. And just as matter and energy can be transformed into different kinds of matter and energy, an idea can lead to another subsequent idea, particularly during a period of heightened awareness of the inventor when his brain is searching for a solution to a problem.

Technological advance is a logical step-by-step progression from a base of past knowledge and experience integrated with new knowledge to yield a solution. We use existing knowledge and experience plus logical thinking to create new knowledge. We scientists and engineers are combiners of facts and interpreters of data; we are technicians, not magicians. Thus, some might say that inventing is an analytical or logical “left brain” activity, rather than being a creative “right brain” process.

To paraphrase Edison, one of the greatest pioneering inventors of all time: “Inventing is 1 percent inspiration and 99 percent perspiration.” The 1 percent inspiration may be viewed as the conception of an idea by deductive reasoning based on knowledge plus experience deposited as memory in the brain. This memory is accessed when we are looking for a solution to a problem. The 99 percent perspiration is the effort that follows conception and is needed to prove the concept and to complete the invention. (Edison’s saying is essentially the second law of inventing, which is introduced and discussed in Section 5.5.)

3.5. THE PROCESS AND PRODUCT OF INVENTING

We should separate the cognitive *process* that leads to patentable inventions, which is ordinary common-sense thinking, from the *product* of the process (the invention), which may range anywhere from truly pioneering to downright mediocre. The process to invention is always by deductive logic based

on what we know and have experienced, combined with how these assets are organized in our brain. The impact of the product of this ordinary thinking process on society is often difficult to foresee, because it is influenced by a variety of external factors (economic, political, geographic, health, etc.) at the time the invention becomes known.

Every patent is a technical *and* legal document, and the patent system combines technology and law by means of a unique set of logic. Despite the fact that the patent system represents a truly intellectual discipline, it is regrettable that the instruction of patent law to science and engineering students is largely ignored in most universities, even those with strong science and engineering departments.

3.6. PIONEERING VERSUS MEDIOCRE INVENTIONS: THE TOUCH OF THE EXPERT

How can we foster pioneering patentable inventions in preference to mediocre or incremental improvement patents? Here is where *expert* knowledge kicks in. The expert knows his technology thoroughly and has a heightened appreciation in which direction to look for a pioneering invention (patent). He knows his technical domain thoroughly and knows which direction a truly disruptive advancement will likely come from. And if given the chance, the expert will move toward pioneering inventions (patents) and not toward incremental improvements.

3.7. THE IMPORTANCE OF INDUSTRIAL EXPERIENCE

As to the question of how to cultivate patentable creativity, my best advice to science and engineering graduate students is that after school they should spend a few years in industry where they will have to learn how to solve problems and will be introduced to the nitty-gritty of the invention protection (meaning patenting) process. In industrial research and development the young technical employee will rapidly appreciate the importance of utility and novelty, concepts essential for inventing.

But the time may come for some truly inquisitive and inventive industrial employees, when they feel hemmed in by shorter-term technology development assignments, which tend to stifle pioneering inventing and patenting. If this individual wants to broaden his experience, he may need to balance practicality (meaning business requirements), on the one hand, and freedom to pursue pioneering creativity on his own, on the other hand. Practicality without creativity is less productive to improve the way we live our lives.

An inventor who possesses only practicality and no creativity cannot develop disruptive inventions (pioneering patents) because he merely follows the plans and instructions of his supervisors. However, creativity without practicality is also less productive. An inventor who possesses only creativity and no practicality will have difficulty inventing useful things because his inventions will not be grounded on what society needs.

3.8. THE ULTIMATE GOAL: INNOVATION

The successful inventor must progress beyond invention, meaning conception and reduction to practice. Reduction to practice is a legal term, which means that the inventor demonstrated the invention is performing as visualized in conception. In Chapter 5, we define the second law of inventing as

$$I = C + Rp$$

where *I* is invention, *C* is conception, and *Rp* is reduction to practice.

It is not enough, however, for the inventor to only be aware of the first and second laws of inventing (see Chapter 5), he must also be aware of the

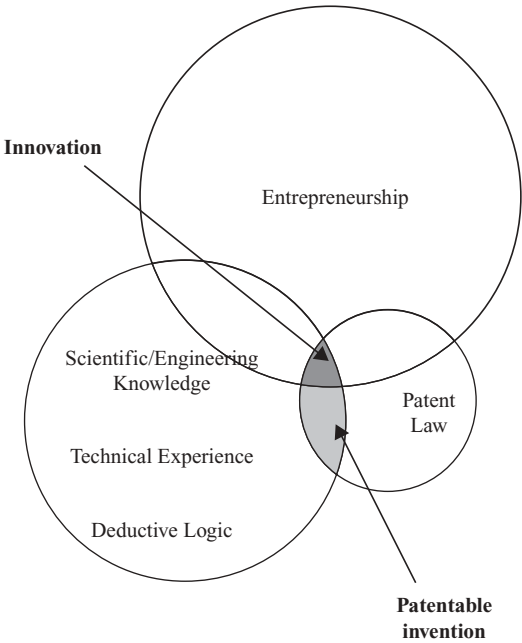


FIGURE 3.2. Requirements for innovation.

law of innovation (presented in Chapter 13). In other words, the inventor must go beyond recognizing the need and applying scientific or engineering principles to satisfy it; he must also put the invention into practice. Innovation is the translation of an invention or an idea into a product or service in the marketplace. Only by combining technical competence *and* a measure of legal knowledge will the inventor know *how to invent and protect his invention*, and only then will the invention have a ghost of a chance to mature into innovation—that is, enter the marketplace and be of benefit to society. Or, to put it somewhat differently, successful scientists and engineers must have the capacity to posit a hypothesis that produces meaningful data, which they are able to interpret to become new knowledge, which in turn will lead to patentable inventions and ultimately to marketable innovations. Only if the invention is protected by patent will investors come forward to provide risk capital for development so the invention can become innovation. Invention without innovation is of little value (these matters are discussed in Chapter 13). This proposition is illustrated in Figure 3.2 by combining the Venn diagram of Figure 3.1 with the large circle signifying entrepreneurship. In order for innovation to arise, both patentable invention and entrepreneurship must be present.

Subsequent chapters concern the basics a scientist or engineer must know in order to invent in the legal sense, and they discuss how to go about protecting an invention.

CHAPTER 4

A SHORT SUMMARY OF INTELLECTUAL PROPERTY

Intellectual property encompasses a wide variety of intangible creations, including scientific inventions, chemical compounds, software, musical compositions, literature, architectural designs, commercial logos, company names, images, and even secrets. Unlike tangible goods that can be physically possessed, intellectual property owners have no physical means of preventing others from using their creations or to capture the monetary value of their work. Intellectual property protection was created to encourage individuals and organizations to create, invent, and develop by giving them the legal right to prevent others from using their work for a limited period of time, thus creating an economic incentive for research and development. Each country has its own intellectual property system. Though most countries' systems are similar to that of the United States, each country has specific rules and requirements, including separate filings to protect intellectual property rights in their jurisdiction. (These matters are discussed in Chapter 12).

The global community recognizes four major types of intellectual property: patents, trade secrets, copyrights, and trademarks.

4.1. PATENTS

Patents encourage innovation by protecting inventions that are an advancement over existing technology and methods. In the United States, there are three major classes of patents:

- Utility patents, which protect any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement on these.
- Design patents, which protect original and ornamental designs for manufactured products.
- Plant patents, which protect new varieties of asexually reproduced plants.

Our book focuses on the utility patent, which is the most commonly issued patent and is of particular importance to scientists and engineers. Famous patented inventions include hybrid automobile technologies, the allergy medicine Claritin®, and the light bulb, which was patented by two Canadian inventors who sold their rights to Thomas Edison. While software is occasionally patentable, it more commonly falls under copyright law (see Section 8.2). Patents are granted to the inventor and allow the inventor (or whomever the inventor assigns rights) to exclude others from making, selling, using, or importing the patented invention. Utility and plant patents last for 20 years from the date they are applied for; design patents last 14 years from the date they are issued.

4.2. TRADE SECRETS

Trade secrets are confidential formulas, practices, and know-how that are protected only by their secrecy and that give the trade secret holder a competitive advantage. They can be disclosed to others under confidentiality agreements (see Section 11.2.1.3). From a practical standpoint, trade secrets are the opposite of patents in that patents require complete disclosure of the nature of the invention and how it was made, but they guarantee protection for a limited period of time. Trade secrets can potentially last forever, but there is no guarantee of protection. Trade secrets work best if the secret is known by only a few persons, cannot be reverse engineered, and is unlikely to be independently developed by other companies. Trade secrets are broader than patents and can be used to protect things that would not be patentable. Examples of trade secrets are a chemical manufacturing process, Google's search algorithm and the recipe used to make Coca-Cola.

Trade secret owners can sell or license their secrets to others by contract. Courts offer some legal protection for secrets that are valuable, kept secret through reasonable precautions, and stolen by a competitor using illegal methods.

4.3. COPYRIGHTS

Copyright promotes creativity by giving authors, artists, composers, computer programmers, and other creators special rights to exclude others from selling and using their work. Copyright protects original and expressive creative works that fall into seven major categories:

- Literary works, including computer programs
- Pictorial, graphic, and sculptural works
- Architectural works
- Musical compositions
- Sound recordings
- Dramatic, pantomime, and choreographic works
- Motion pictures and other visual works

Copyright law protects expression, not ideas, meaning that it only protects creative output that is fixed in a tangible medium, such as text, pictures, or a musical score. It does not protect intangible things such as ideas, concepts, or methods of doing things. Thus, a copyright could be filed to protect Leonard Bernstein's original music for *West Side Story* or to protect Stephen Sondheim's lyrics, Arthur Laurents's script, or Jerome Robbins's choreography. A copyright could not be filed to protect the general plot of a young couple torn apart by two warring gangs, regardless of whether Shakespeare came up with the idea first. As copyright law applies to software, this means that a copyright owner can prevent others from using the written language of the code, but cannot prevent others from writing a program that performs the same function. As previously noted, some software programs are patentable and a very broadly written patent could prevent others from writing a program to perform the same function as the patented program. However, most software programs are protected by copyright.

Copyright law only protects works that show at least a modicum of creativity. A telephone directory (an alphabetical compilation of names and addresses) is not copyrightable because it lacks creative expression. Physical objects, such as a toy, may be protected by copyright only if they contain an aesthetic, creative element, such as the play board of a Monopoly game,

which shows an expression of creativity. By law, U.S. government publications, including patents, are not copyrightable and can be freely copied.

Copyright comes to life the moment a work (poem, jingle, picture, sculpture, film, novel, computer software, etc.) is created. Registration is not necessary for a work to receive copyright protection, but filing is the best way to establish a public record of ownership of the work. Registered copyrights generally last for the author's life plus 70 years, although there are some exceptions that apply depending on who owns the copyright and when it was created.

Copyrights holders have the exclusive right to copy, distribute, perform, display, or create derivative products from a copyrighted work. Some exceptions permit others to use portions of a copyrighted work, including the oft-discussed *fair use exception*, which allows people to use small portions of a copyrighted work for teaching, research, or news reporting without the permission of the copyright owner.

4.4. TRADEMARKS AND SERVICEMARKS

The aim of trademark law is to promote economic competition and minimize consumer confusion about who created a product. Trademarks and servicemarks protect a word, phrase, symbol, or design that is used in commerce to identify or distinguish a product from others. Common examples of trademarks are business names like Exxon or Cisco, the Nike swoosh, and Adidas' use of three stripes on athletic shoes. Most trademarks are used to protect names or logos, but even smells, colors, sounds, or types of packaging can be trademarked if they serve to identify a product *and* are distinctive. Trademark owners can prevent others from copying, reproducing, counterfeiting, or imitating their name or logo. They can also stop others from using similar names or logos that might confuse people or mislead the public as to who made a given product. For example, selling batteries under the label "Durasell" might infringe Duracell's trademark because consumers would be likely to grab Durasells off the shelf, thinking that they had been manufactured by a well-established battery brand. The potential consumer confusion would give Duracell grounds to prevent Durasell from using its similar name.

Trademarks exist indefinitely as long as they are being used in commerce, meaning that a business is selling products or services under the name or displaying the logo. The Anti-Cybersquatting Consumer Protection Act even protects trademark owners from web users that try to cash in on their name. In practice, the law makes it illegal for a tech-savvy business person to buy the web domain name "Disney.com" with the intent of either extorting money from Disney or tricking Internet users into coming to the website.

TABLE 4.1. Summary of Patent, Trademark, Copyright, and Trade Secret Protection

	Patent	Trade Secret	Copyright	Trademark
Protects	Inventions	Know-how, which may include inventions	Creative works	The brand or trade name of a product or organization
Ownership	Inventor or inventor's employer	Individual or company that originated the secret	Author or author's employer	Individual or company that uses the mark
Duration	20 years for utility and plant patents, 14 years for design patents	Potentially infinite, until secret becomes publicly known	Life of the author plus 70 years (generally)	Potentially infinite, as long as the mark continues to be used
Rights given	Right to prevent others from making, using, selling, or importing the patented invention	Right to sue others who steal the secret	Right to prevent others from copying, distributing, performing, or displaying the work, as well as creating derivative works	Right to prevent others from copying the mark or from using a similar mark that is likely to confuse or mislead the public
Requirements	Useful, novel, and unobvious	Valuable information and reasonable precautions to keep the info secret	Original, expressive, and fixed in a tangible medium	Distinctive, identifying, and used in commerce

Table 4.1 summarizes the main features of various types of intellectual property.

4.5. OTHER TYPES OF INTELLECTUAL PROPERTY

In addition to the four major types of intellectual property listed above, there are a handful of other intellectual property rights protected by law. Among these, some of the more common are as follows:

- Geographical indications apply in a manner similar to that of trademarks and prohibit sellers from asserting that their goods are from a particular geographic region if they are not. For example, “Florida Orange Juice”

must actually be from Florida, and “Blue Mountain Coffee” must be either from Jamaica, where the Jamaican Blue Mountain is located and where coffee is grown, or possibly from Australia, where they also have Blue Mountains.

- Moral rights apply to a small subset of creative works that are also copyrightable: original copies of pictorial works, or copies of limited edition pictorial works with fewer than 200 copies in existence. Examples would include a canvas painted by Mark Rothko or one of only 50 numbered copies of a painting by a lesser-known artist. Authors of these works are entitled to attribution, having the work published in their name or anonymously as they choose. Well-recognized works also receive the right of integrity, which means the work must be preserved against intentional destruction, distortion, or mutilation.
- Publicity rights, which are exclusively created by state law, protect an individual’s right to control the commercial use of his identity, including his name, voice, signature, likeness, and performance style.
- Database rights allow owners of valuable databases to prevent others from copying or disseminating their work. Databases generally do not contain creative expression, so they are ineligible for copyright protection.
- Mask works are graphic representations used to create electronic circuitry on semiconductor chips and are protected by the 1984 Semiconductor Chip Protection Act. The owner of a mask work has the exclusive right to reproduce or import its accompanying semiconductor chip for 10 years. Mask works may cost upwards of \$100 million to develop. As mask works usually do not meet the novelty and unobviousness standards for a patent, nor the creative expression requirement of copyright law, this new class of intellectual property was established to provide some economic incentive to the creators.

CHAPTER 5

REQUIREMENTS OF PATENTABILITY

5.1. WHAT IS PATENTABLE?

The Patent Law or Patent Statute is Title 35 of the United States Code (U.S.C. 35), and it governs all patent cases coming to the U.S. Patent and Trademark Office (PTO) and the court system. The roots of this patent law are found in the U.S. Constitution (see Section 2.2). One of the first paragraphs, Section 101 of the law, sets the stage by defining what is patentable:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

One of our objectives is to encourage you, the young technical professional, to invent. Understanding the following basic concepts will help you become an inventor:

1. What can and cannot be patented as an invention (statutory classes)
2. What are the basic requirements of an invention (the first law of inventing)
3. What two steps make an invention (the second law of inventing)

How to Invent and Protect Your Invention: A Guide to Patents for Scientists and Engineers, First Edition. Joseph P. Kennedy and Wayne H. Watkins with Elyse N. Ball.
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A word of caution on the language of Section 101 of the statute: “Discovers” means something more specific under the Patent Law than it does in common usage. Someone can discover a new planet, a new species of animal, or the way certain molecules behave in solution. However, these “discoveries” are not patentable under U.S. Patent Law, as will be discussed below.

Let us address these concepts.

5.2. PATENTABLE AND NONPATENTABLE SUBJECT MATTER

The Patent Law clearly defines what can and cannot be protected by patent in the United States (see the quote above). Thus, the following are patentable:

- *Processes or methods* (these terms are synonymous), that is, making something in one or several steps—for example, chemical reactions, software and business methods.
- *Machines*, that is, engines, devices, or mechanical contraptions that are capable of performing a useful function by the interaction of parts.
- *Manufactures*, that is, manufactured products and articles without movable parts made by hand or machine, such as a safety pin or paper clip.
- *Compositions of matter*, that is, chemical compounds, polymers, drugs, and manmade microorganisms or animals.
- *Improvements of the above*, that is, a new use for something old.

Inventions must fall within at least one of these categories. The invention may be properly classified in more than one category. When the inventor applies for a patent, the Patent Office does not require her to specify the category.

In contrast, the following cannot be patented:

- *Laws of nature*—for example, the law of gravity or electricity. While a law of nature is not patentable, the use of such a law to accomplish a purpose is. And it is not necessary for the inventor to understand the law, just to use it. Invention is not about intellectual discovery of laws but applying them to useful ends.
- *Products of nature*—for example, a natural element, a rock, a plant, or an animal, even if the applicant discovered a new species.
- *Scientific principles or theories*—for example, the survival of the fittest.
- *Abstract ideas*—for example, religious or philosophical ideas.

- *Illegal objects*—for example, burglary tools or counterfeiting devices (unless they can also be used for legal purposes).
- *Purely esthetic creations*—for example, Beethoven’s symphonies or Michelangelo’s sculptures, paintings, and poems. These creations fall under U.S. Copyright Law, a topic outside the scope of this book.
- *Mathematical algorithms, formulae, and equations*—for example, Einstein’s equation $E = mc^2$.
- *And by special act of Congress, inventions solely for special nuclear materials or for atomic weapons.*

5.3. THE THREE CLASSES OF PATENTS

Patent law recognizes three classes of patents: utility, design, and plant. In this book we are concerned primarily with *utility patents*, the most important class of patents in terms of numbers of patents granted, as well as the total value of the protection awarded to patent owners (see Section 4.1). Utility patents include mechanical, electrical, chemical, and biological inventions. A utility patent can usually be obtained for just about any new and useful invention the human mind can conceive, be it a new toy or cure for cancer. For completeness, we mention that design patents protect the shape or design of an object like a Coca-Cola bottle, and plant patents cover asexually reproduced plants. The concepts discussed in this book generally apply only to utility patents. Design and plant patents are beyond the scope of this book.

We are now ready to discuss requirements of patentability.

5.4. THE FIRST LAW OF INVENTING

The following equation summarizes the legal requirements of a patentable invention:

$$I = U + N + U'$$

where I is invention, U is utility or usefulness, N is novelty or newness, and U' is unobviousness. We refer to this law as the *content law* because it lays out the contents required of a patentable invention. These three requirements are spelled out, respectively, in Sections 101, 102, and 103 of the Patent Law. In order for a thing to be patentable, these three requirements are essential and must coexist!

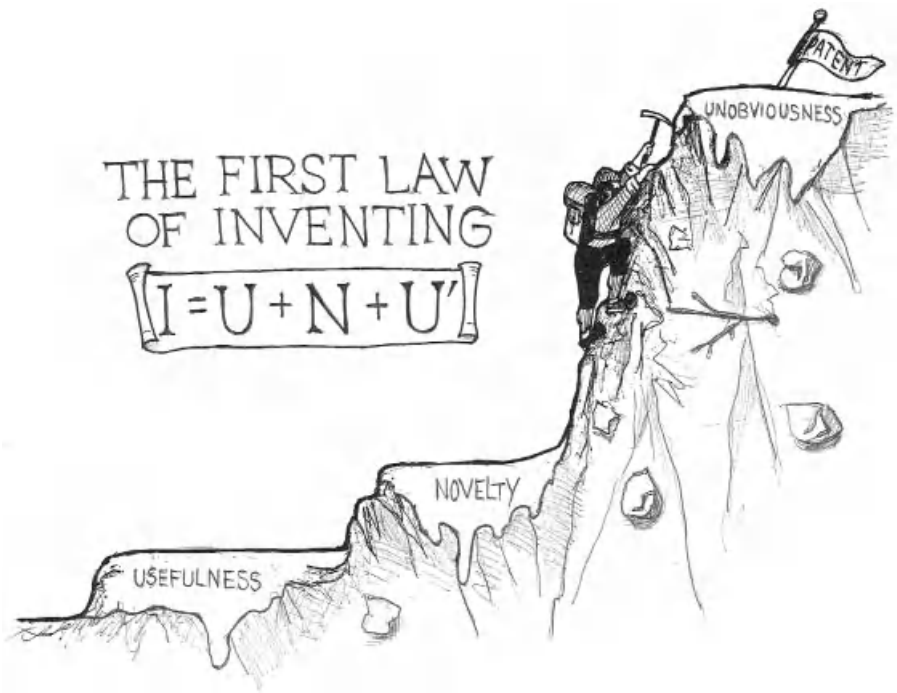


FIGURE 5.1. Scaling the patentability mountain. To reach the goal of a patent, one must reach each of the separate threshold standards for usefulness, novelty, and unobviousness.

It is relatively easy to comply with the utility requirement, it is more difficult to meet the novelty requirement, and it is often most difficult to satisfy the unobviousness requirement. This is illustrated in Figure 5.1.

5.4.1. Utility

For an invention to be patentable, it must be useful. Utility or usefulness is implied by the constitutional provision that an invention “. . . must promote the progress of science and *useful* arts . . .” and is further reflected in Section 101 of the Patent Law that “whoever invents any *useful* process . . . may obtain a patent therefor” (see also Section 5.1).

In contrast to novelty and unobviousness (see below), the utility requirement is relatively easy to meet. While no standards of utility were established by Congress and the law does not define utility, the law requires an assertion of usefulness and an indication on “how to use” the patent. For example, a person who could first demonstrate that a dilute solution of Tylenol (a popular

cold remedy) sprinkled on the lawn would make it grow faster and greener may obtain a new use patent.

The courts have grappled with the concept of utility and formulated standards for it. According to judicial interpretation, an invention is useful if it is able to perform some claimed beneficial function, provided that the function is not exclusively frivolous or illegal. For example, inventors cannot claim that an expensive genetically modified mouse is useful as snake food, because this would be a frivolous use of the invention. Similarly, a method for extorting payments would not be patentable because illegal things are not patentable.

If the specification contains an unusual or hard-to-believe allegation of utility—for example, it describes a composition of matter or process that will reverse baldness—the examiner may require the applicant to submit proof for it.

The beneficial function usually must be stated, but it is not necessary to perform it to a high degree of perfection. In mechanical and electrical inventions, utility is inherent and does not need elaboration. However, in chemical, pharmaceutical, and particularly biological inventions, utility must be clearly stated and explained. In practice, this means that the inventor must put a definite statement of utility in the specification portion of the patent document. Potential reasonable uses for these kinds of inventions could include usefulness as a catalyst, high blood pressure treatment, intraocular lens, or hydrophobic coating.

Few inventions have been rejected for lack of utility. However, the utility requirement does prevent (at least in part) the patenting of inventions purporting to accomplish the impossible (e.g., perpetual motion machines). Occasionally, chemical compounds or DNA sequences with no known utility have also been denied a patent for lack of utility. Specifically, one court denied a patent for a sequence of five nucleic acids in corn that had no known utility except possible use as a genetic marker in the future. In *Brenner v. Manson*, a judge colorfully explained that “a patent is not a hunting license” in denying a patent application claiming rights to a steroid that had not shown any useful properties but was an adjacent homologue to a tumor inhibiting steroid. The judge said he would not grant a patent without some proof that the new steroid had similar properties or some other use.

Drugs and medicines represent a special case with respect to utility. According to the Food and Drug Administration, a new drug must be proven safe and efficacious before it can be sold; however, the PTO has no such requirements. Thus, it is possible to obtain a patent on a new drug, and yet it cannot be marketed because it does not meet the requirements of the FDA.

In conclusion, to meet the utility requirement, a patent application must state some use for the invention that is not frivolous or illegal. We

recommend the student pick up any U.S. patent (for example, by going to www.google.com/patents) and locate the sentence or sentences that describe utility.

5.4.2. Novelty

For an invention to be patentable, it must be novel. The definition of novelty is a matter of patent law and is quite different from what is commonly thought to be newness. It is best to reproduce Section 102 of the law that defines novelty:

- (a) *A person shall be entitled to a patent unless . . . the claimed invention was patented, described in a printed publication, or in public use, on sale, or otherwise available to the public before the effective filing date of the claimed invention . . .*
- (b) *Exceptions. . . . A disclosure made 1 year or less before the effective filing date of a claimed invention shall not be prior art . . . if the disclosure was made by the inventor or [by someone who learned about the invention from the inventor] . . .*

According to these subsections, a patent cannot be obtained if the invention was disclosed in the prior art. *Prior art* is a legal term for anything published or printed, sold, or publicly used anywhere in the world prior to the date the patent application was filed. Following are examples of specific disclosures that constitute prior art.

- Prior printed publications—for example, a book, patent, journal article, pamphlet or advertisement, even if it is in another language.
- U.S. patent applications filed by others before the inventor's patent application is filed.
- Public knowledge that is widely known, even if it is not written down.
- Public use of the invention—for example, demonstrating the product or process to others, using the product in public, or distributing products for advertising purposes.
- Prior sale or offer for sale—for example, placing the product on store shelves, advertising the product's sale in a magazine, or creating a website to sell the product.

The use of an invention prior to patenting makes the invention unpatentable only if it is a *public* use. A public use is any use of the invention by or in front of people not bound to confidentiality. Demonstrating an invention in public

would be public use, as would sharing the invention with potential buyers. For example, a New York chef flies to Paris to visit a friend from culinary school. One night she observes her friend as he works in a restaurant, and she notices that he use a gadget to prepare a popular gourmet dish. She suddenly realizes that this gadget is likely unknown in the United States. After she returns to the United States, she files a patent application claiming the gadget. The gadget would not be eligible for a patent because it is no longer novel, as it has been used in public commerce. She would also be ineligible to obtain a patent because she is not an inventor; that is, she could not sign the oath (see Appendix 1, Form A) stating that she believes she was the first to conceive the idea for the invention.

As another example, a chemist in a company develops an additive for pavement, which makes the pavement more durable and crack-resistant. The company applies it to a stretch of highway (with permission from government agencies) and leaves the pavement in public use for a year. This additive may not be patentable because it was in public use.

However, there is an exception to the public use rule for *experimental use* of an unpatented product or process. This exception allows an inventor or company to publicly use or sell a product or process without destroying patentability, so long as the use is part of an experiment to prove utility. If the chemist visits the stretch of highway that contains the asphalt additive each week, checking it for cracks, performing tests, and making detailed notes, this likely falls under the experimental use exception and the additive may be patentable. If the inventor sells the additive to a government entity to try out the product, it might similarly fall under the experimental use exception.

In contrast to public use, an inventor can always share details of his invention with his patent attorney who is bound to confidentiality or anyone who has signed a *Non-Disclosure Agreement* (see Section 11.2.1.3). If the invention is going to be owned by a business or university, the inventor can generally share his invention with co-workers and lab mates, who are bound to confidentiality by company policy or by employment agreement.

5.4.2.1. The One-Year Rule. Section 102(b) creates an exception to the rule that disclosure destroys patentability. Under this narrow exception termed the *one-year rule*, an inventor may patent an invention within one year of its disclosure if the disclosure was made by the inventor, a co-inventor, or someone who learned about the invention from the inventor. It is particularly important for university researchers to know that if an inventor publishes a journal article describing the invention, a patent application must be filed within a year, otherwise the right to patent will be irretrievably lost. In other words, publication, public use, or sale of the invention anywhere in the world

more than one year before filing a patent application destroys novelty—that is, it is a *statutory bar*.

Under the 2011 America Invents Act, the language of Section 102(b) has been substantially altered. The old Section 102(b) was more detailed about what types of disclosures fell under the one-year rule and included patents and printed publications in any country, as well as public uses and sales of the invention in the United States. Because the new Section 102(b) uses the term “disclosures” and fails to specifically mention either public uses or sales of the invention, some cautious patent attorneys have suggested that public uses and sales will fall outside of the one-year rule. This would mean that any public use or sale of the invention anywhere in the world would immediately destroy patentability. Only time will tell whether these lawyers are being overly careful, as they must wait and see how courts will interpret the term “disclosures.” At a minimum, most people are confident that journal publications and other written materials will continue to fall under the one-year rule.

Because of the one-year rule, inventors and companies sometimes publish a *defensive publication* to protect novelty. A defensive publication can, for example, be a journal article or a public presentation to show that the inventor was the first to disclose the idea. Anyone (other than the inventor) who attempts to patent the invention after the defensive publication will not be able to meet the novelty requirement. The inventor can still patent the invention within one year of the defensive publication.

Finally, it is important to note that most other countries do not have a one-year grace period like that of the United States, and any form of disclosure or public use of an invention immediately destroys novelty. Inventors hoping to file foreign patents should not write about or present their inventions until after a patent application has been filed.

In conclusion, in the United States, the one-year rule allows an inventor to patent an invention up to one year after he discloses the invention.

5.4.2.2. Derivation Proceedings. The *derivation proceeding* is a recent development in U.S. patent law, which replaces the *interference proceeding* beginning March 16, 2013. Under the old first-to-invent patent system, interference proceedings were used to determine priority (who conceived the inventive idea first) when two inventors filed similar patent applications at about the same time. The derivation proceeding replaces this in the new *first-inventor-to-file* system: It settles disputes if two inventors try to patent the same invention.

It is of interest that the U.S. system calls itself *first-inventor-to-file*, emphasizing that being the first to file an application is not enough. One must be an inventor to be worthy of a patent, and an individual cannot obtain a patent for something he did not invent. For example, if an inventor creates

a process for a new medication and then publishes, sells, or demonstrates it, the process will be in the prior art and thus unpatentable by others. The assumption is that those who seek a patent after someone else has publicly disclosed it may have taken the idea from the disclosure. Alternatively, if the inventor does not publish, sell, or demonstrate the process but discusses or shares it with a colleague, the process is not in the prior art. If the colleague then tries to patent the process, he would not be the inventor and should not be entitled to a patent. Derivation proceedings protect against unworthy patent applicants—that is, applicants who did not actually make the invention but tried to patent it.

Let us contrast the derivation proceeding with the now-defunct interference proceeding. Both proceedings take effect when two or more applicants seek a patent for the same invention. Interferences were used to determine who, among two or more applicants, conceived the idea for the invention first and “diligently” reduced it to practice. In contrast, in a derivation proceeding, it does not matter who conceived the invention first or who first reduced it to practice. If both applicants in a derivation proceeding invented the same thing, the one who filed earlier will win. However, if the later applicant can show that the earlier applicant *derived* the invention from the later applicant’s work, the later applicant is entitled to the patent; that is, the earlier applicant is a “deriver,” not an inventor.

To institute a derivation proceeding, the inventor must file suit within one year of the publication of the allegedly derived patent application, and he must have an application on file claiming the same invention as the person he is opposing. Presumably, it would be possible to file a patent application for the sole purpose of starting a derivation proceeding. The person instituting the derivation proceeding is the *later patent applicant*. In a derivation proceeding, the inventor must declare under oath and present evidence that the earlier applicant derived the invention from the later inventor’s work and filed an application based upon this work without the inventor’s authorization. The Patent Office Director determines which derivation suits are allowed to proceed, and his decisions are final. If the director allows the suit to proceed, the matter is argued before a panel of the Patent Trial and Appeal Board, who must decide whether derivation occurred. The Board can defer making a decision until three months after a patent has been issued to the earlier patent applicant; that is, the Board need not listen to cases unless the Patent Office grants a patent. If the Board finds that the earlier patent applicant derived the invention from the later applicant, the earlier patent application is denied; or, if the patent has already been issued, the derived claims are canceled. Parties to a derivation proceeding may sign a written agreement to settle their dispute.

5.4.2.3. Anticipation. Before we leave the subject of novelty, we must become acquainted with the concept of anticipation, the antithesis of novelty. The first step in determining whether an invention is novel is to carry out a patentability search to explore the pertinent *prior art*. The expression “prior art” means all existing publicly available knowledge anywhere in the world anytime before the date of the patent application. Obviously, the inventor hopes that this search will be futile and that no prior art will be found to cover the claims. Patent lawyers have a good expression for what happens when prior art covers a claim: They say that prior art *reads on* the claims, which is meant to imply a precise correspondence between the claimed material and the new invention or product.

When trying to uncover prior art, three kinds of searches of increasing extensiveness can be used: (a) *bibliographic searches* of scientific periodicals and journals, which a science or engineering graduate student can do; (b) *patentability searches* where published patents are evaluated for novelty and unobviousness, typically by a patent professional; and (c) *validity searches*, an exhaustive search carried out during an infringement proceeding trying to demonstrate that the PTO made a mistake and the patent is invalid. Because there are countless prior publications, patents, public uses, and other sources to uncover, no patent search can ever be complete.

If pertinent prior art is found that reads on the claims, the invention is anticipated and a patent cannot be obtained. Anticipation (an earlier reference that reads on all the claims) destroys novelty. The fact that the inventor did not know about a pertinent reference before the invention was completed is irrelevant. Anticipation differs from unobviousness (which is discussed below) in that anticipation applies when a single prior art reference reads on the patent claims and destroys patentability. Unobviousness applies when a combination of multiple prior art claims work together to read on the claims and destroy patentability.

5.4.3. Unobviousness

For an invention to be patentable, it must *not* be obvious (must be unobvious or nonobvious) based on known science and technology (Figure 5.2).

The definition of unobviousness is a matter of law, set forth in Section 103 of the Patent Law:

A patent for a claimed invention may not be obtained . . . if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains

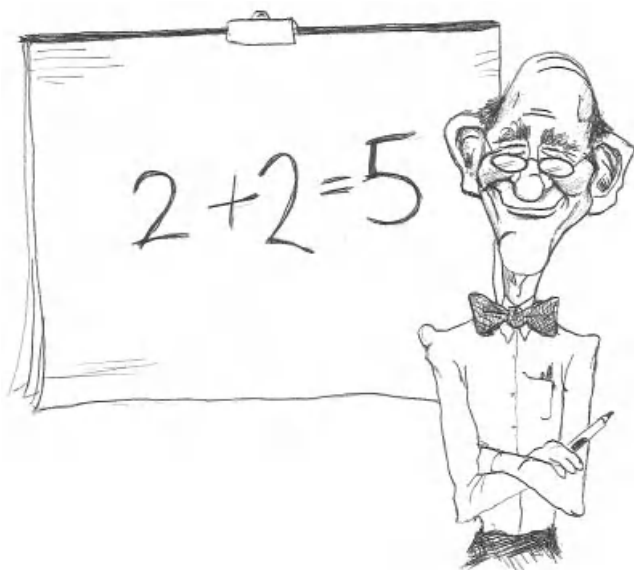


FIGURE 5.2. Synergism: An invention becomes unobvious if the result of a combination of steps exceeds the sum of the individual steps.

While Section 103 makes a valiant effort to define unobviousness, a concept central to patents, it is a far from satisfactory definition, particularly for scientists and engineers who generally like clear and precise boundaries. Thus, it is perhaps surprising, indeed amazing, that judges and elected representatives, with input from patent professionals, have been unable to develop a better (more precise) definition for unobviousness after more than a hundred years. The fact that they could not develop a clear and precise rule is due more to the nature of the problem than to the inadequacy of judges and legislatures. The problem is that most people think a patentable invention should require more than just usefulness and novelty (i.e., serving some useful purpose and not being identical to a previously disclosed invention). However, setting a higher standard that requires special skills and effort on the part of inventors practicing in a wide array of scientific fields presents a serious challenge.

Section 103 may make more sense if we look at it as being dependent on three major elements: (1) the claimed invention as a whole, (2) the state of the prior art before the effective filing date, and (3) a person having ordinary skill in the art. When assessing inventiveness, we must look at the totality of the invention, not just whether individual components of the invention had been previously disclosed or are obvious. Similarly, we can only look at prior art that exists before the date the patent application is filed. Prior art is any scholarly article, public presentation, published patent application, or other

explanation known to the general public, as well as any sale or public use of a device.

A *person having ordinary skill in the art* (often abbreviated as PHOSITA) is an ordinary person who supposedly knows the entire prior art, whose ability to “invent” is the yardstick of unobviousness. Courts have held that if a PHOSITA could have invented a particular thing, then that thing was obvious and therefore unpatentable. As a practical matter, we may assume that a PHOSITA is a reasonably educated or experienced scientist or engineer who has obtained roughly the average level of education in his field. For example, a PHOSITA in biomedical engineering is likely to be a Ph.D., while a PHOSITA in engineering would have his master’s degree.

A PHOSITA is somewhat creative (i.e., he can combine multiple prior art references to solve a problem), but he cannot exercise anything beyond the level of “ordinary creativity.” Ordinary creativity is typically found in everyday tasks. For a farmer, it may be finding new patterns of planting and procedures for harvesting crops. For a homemaker, it may be a change in the cooking recipe using available ingredients. She may be using the creative process to create novel taste sensations or nutrition results. Extraordinary creativity could be a disruptive invention such as the integrated circuit or the new class of compounds that comes from specialized research. Unfortunately, most patent applications fall somewhere between ordinary rearrangement to solve a simple problem and disruptive inventions that create new scientific fields. No wonder that countless court decisions grappled with the concept of unobviousness and came up with contradictory judgments.

The following oft-quoted sentence crafted by an early nineteenth-century judge in regard to unobviousness is reproduced here to demonstrate the difficulties of obviousness:

If that which appears, at first blush, to be obvious though new is shown by evidence not to be obvious, then the evidence prevails over surmise or unsupported contention and a rejection based on obviousness must fail.

5.4.3.1. *Aggregates and Composites.* Courts have previously explained that for a blend, mixture, multiple parts machine, and so on, to be unobvious, the whole must in a surprising or unexpected manner exceed the mere sum of parts. Assume that pencils were known and that someone placed an eraser (also known) on the end of a pencil and applied for a patent on this certainly useful and new *aggregate*. Chances are that the patent examiner will find the functioning of the pencil-cum-eraser entirely foreseeable (obvious), arguing that the lead writes, the eraser erases, and the thing as a whole lacks

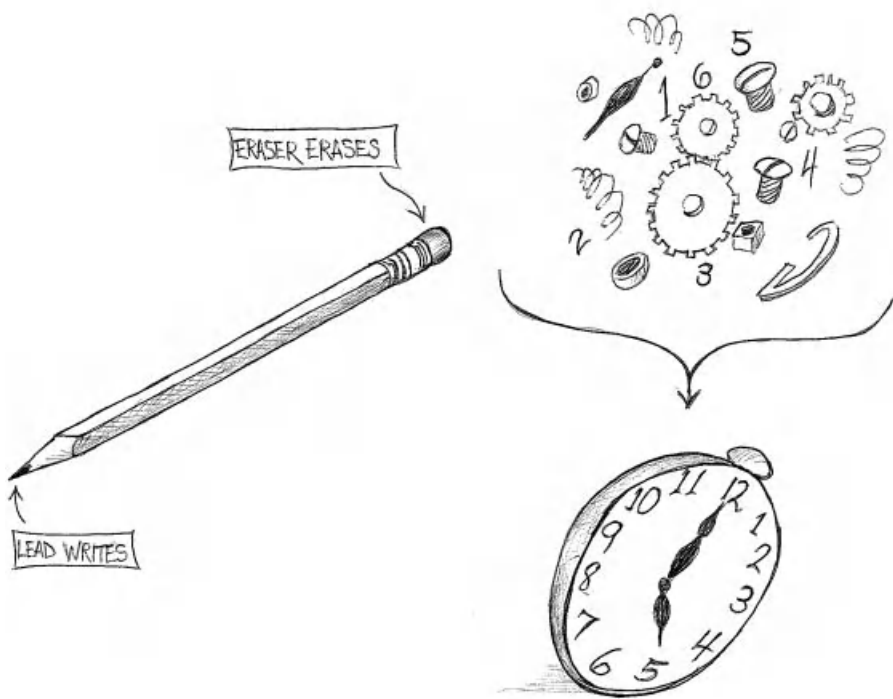


FIGURE 5.3. Aggregate (unsurprising and therefore, nonpatentable) and composite (surprising and therefore, patentable).

unexpected or surprising features. In contrast, consider that someone first invents the clock or watch, that is, a device that contains a great variety of disparate components (springs, screws, rods, a dial, hands, etc.) which, when properly assembled, surprisingly show the passage of time. The watch or clock is certainly an unobvious *composite* of components and will therefore be patentable. This older standard is rarely used by courts today, but it is still instructive to illustrate the nature of unobviousness (Figure 5.3).

5.4.3.2. The Teaching-Suggestion-Motivation Test. A more recently developed, but still controversial, standard for determining unobviousness is called the teaching–suggestion–motivation (TSM) test. Matter disclosed in the prior art, like information listed in a published patent application or a peer-reviewed journal article, is said to be taught. While assessing unobviousness has always required one to look at what is taught (i.e., disclosed) in the prior art, the TSM test moves further and asks whether anything in the prior art would suggest or motivate a researcher to develop the invention that is the subject of the patent. For example, springs, screws, and gears are all

widely used in industry, and using combinations of gears to turn a complex series of mechanisms at a precise rate has been disclosed in prior patent applications. An inventor then attempts to file a patent application on a pocket watch. Under the TSM test, the patent examiner must ask whether anything in the prior art would suggest that a combination of springs, screws, and gears could be used to tell time. Furthermore, the examiner would look for references in the prior art that would motivate an inventor to employ the particular techniques he used to solve the problem. A published patent application that used springs and gears to make a grandfather clock might suggest that this could be done on a smaller scale to create a pocket watch and might prove lack of unobviousness. Similarly, a journal article about the importance of telling time precisely in modern industrialized societies and noting that gears can be used to precisely control rotation in time increments would likely motivate an inventor to explore this solution further and could be used to show that the invention is obvious. However, an article that merely notes a dearth of convenient ways to keep track of time would not offer sufficient motivation for the invention that the researcher is trying to patent and would not prove that the invention is obvious.

The TSM test has come under fire in part because some examiners were applying it rigidly and looking only for prior art references that specifically suggested the invention as a method for solving a particular problem. On the other end of the spectrum, there were concerns that even oblique references to a broad type of inventions might be found to suggest or motivate potentially patentable inventions. In a landmark 2007 Supreme Court decision called *KSR v. Teleflex*, the Supreme Court exhorted examiners and courts to exercise reasonable judgment when applying the TSM test and to look at whether a prior art reference would suggest or motivate an invention from the practical perspective of what researchers in the field would think. The court also encouraged patent examiners and other courts to use another means of assessing unobviousness—the Graham factors—as the new standard.

5.4.3.3. Secondary Factors Suggesting Unobviousness. The Graham factors, which come from the 1966 Supreme Court case *Graham v. John Deere*, are four primary elements that patent examiners should look at when assessing unobviousness:

1. The content and scope of prior art
2. The level of ordinary skill in the art
3. Differences between the claimed invention and the prior art
4. Objective evidence of unobviousness

The novel part of the test above is the fourth Graham factor. Factors 1 and 3 simply ask examiners to track down all potentially relevant prior art, to determine the scope of any previously issued patents, and to compare these to the patent application they are examining. The second Graham factor is suggestive of the PHOSITA, asking patent examiners to base their decisions on the skill and creativity likely to be possessed by a person having ordinary skill in the art. However, the fourth Graham factor, objective evidence of unobviousness, gets at information that patent examiners have ignored in the past. Factor 4 is actually made up of a number of potentially relevant pieces of evidence, which are often referred to as *secondary factors* and which look for actual proof that the invention at issue has eluded other scientists. The Supreme Court has laid out three:

- (a) *Commercial success*—for example, orange jack-o-lantern trash bags for collecting fall leaves were found patentable because their multi-million dollar success suggested that someone would have made them earlier if they were truly obvious.
- (b) *Long-felt but unmet need*—for example, a cure for the common cold.
- (c) *Failure by others to come up with the invention*—for example, electrostatic copying was unsuccessfully tried by many before Xerox researchers invented and developed modern photocopying.

Courts have also developed other secondary factors, which include exploring whether the invention solves an unrecognized problem, is in a crowded area of art, or allows a previous invention to be made more easily or with fewer parts. If an invention does not bring about new and unexpected results, it still may be judged unobvious if it satisfies one or more of the above factors.

Because assessing unobviousness requires considerable experience, the help of a patent attorney or agent should be sought. Frequently, except for a small difference, an invention could appear obvious in the view of the prior art; however, this small difference may turn out to be essential for the invention and may render it unobvious. The claimed invention may become unobvious if it exhibits an unexpected or surprising feature on account of this small difference. For example, a chemical compound may surprisingly change its reactivity by the addition of a small group. Thus, the introduction of a methylene group $-CH_2-$ into methanol (CH_3OH), which yields ethanol (CH_3CH_2OH), unexpectedly changes a dangerous toxic liquid, which when imbibed causes blindness, to a pleasantly intoxicating drink valued by many.

5.4.3.4. The Doctrine of Inherency. Sometimes a composition of matter patent cannot be obtained, although the invention is useful, novel, and

unobvious. Consider the following situation: Someone discovers that paper impregnated with a phosphate compound renders it fire-resistant, and he or she proceeds to apply for a patent for fire-resistant paper. The examiner, however, finds prior art that discloses that the same phosphate compound on paper imparts mildew resistance. Thus fire resistance is *inherent* in mildew-resistant paper, and the person cannot get a *product patent* on fire-resistant paper. This is called the *doctrine of inherency*.

As we discussed earlier, inventors can patent more than just products; they can also receive patents on processes and a special kind of patent called a *product-by-process* patent. A product-by-process patent or claim protects the method by which a product is manufactured, such as the steps one takes to produce a novel solar cell or the process one goes through to synthesize an anticancer drug.

Finally, *new use* patents can be obtained where an inventor discovers a new and unexpected use for a previously patented process or product. In this case, the person who discovered the fire-resistant paper may be eligible to receive a process, product-by-process, or new use patent on his invention.

5.4.3.5. Combination of References. Patent examiners often reject applications by citing two or more prior references that in combination render an invention obvious. In such instances, the burden is on the inventor to overcome the examiner's logic and argue unobviousness. For example, Karl Ziegler (Nobel laureate in chemistry in 1957 for the co-discovery of stereospecific polymerization) claimed that his catalyst formed by mixing AlEt_3 and TiCl_4 produced previously unknown high-molecular-weight polyethylene. The patent examiner rejected the claims citing prior references showing that both AlEt_3 and TiCl_4 are catalysts for the polymerization of ethylene; therefore, combinations of these chemicals are also expected to be catalysts. Ziegler had to prove that AlEt_3 and TiCl_4 alone (not in mixtures) produce only low-molecular-weight oils, and that, surprisingly, only their mixtures produce desirable high-molecular-weight crystalline polyethylenes. The patent was issued, a new industry arose, and Ziegler became a wealthy man.

5.4.3.6. New Compounds by Purification. In regard to the concept of obviousness, it is also instructive to examine the oft-cited classic case of the aspirin patent, where a high degree of purification resulted effectively in a new product. Aspirin is a rather simple organic compound (acetyl salicylic acid) that occurs in the bark of certain trees and was used as medicine (analgesic and antipyretic) for centuries. In contrast, synthetic aspirin was a useless chemical that could not be used for medical purposes due to the presence of noxious impurities (free salicylic acid) produced during its synthesis. Felix Hoffmann,

a German chemist working for the Bayer Co., devised a crystallization method to purify synthetic aspirin, which rendered synthetic aspirin for the first time useful for medicinal purposes. He took a worthless substance, purified (and characterized) it, and thus converted it into a valuable medical product. The cases of vitamin B12 and the hormone adrenalin are similar. Adrenalin was known but was useless in its impure form. After adrenaline was extracted from gland tissue and purified, it was held patentable and the hormone became an important medicine. In all these cases, the courts held that the old products had no practical purpose, whereas the new products exhibited new and important uses and therefore were different in kind (unobvious) rather than in degree from the prior art. In contrast, merely purer forms of an old product—differing only in the degree, but not in the kind, of utility—are not patentable because the purer product represents only an expected (obvious) improvement in respect to utility.

5.4.3.7. Differences Between Novelty and Unobviousness. Novelty and unobviousness can overlap, but they are distinct legal concepts. Novelty looks only at whether an invention has been disclosed by someone else before a patent application is filed. It does not matter whether this invention is publicly disclosed as long as a patent application has been filed to document the priority date of the earlier invention. The priority date (or effective date) is the date the invention was disclosed to the PTO and is the earliest filing date of a provisional patent application, regular patent application, or parent application. (We prefer to use the term *priority date* throughout this book, because *effective date* is less descriptive.) Generally, novelty presents a lower hurdle than unobviousness, which looks at not only whether the invention is disclosed in the prior art but also whether the invention is obvious in light of the prior art. This means that even a totally novel product or process fails for unobviousness if the patent examiner finds that a PHOSITA could have made it based on prior art. Most times, an unsuccessful patent application is found to be novel but obvious in light of the prior art; that is, it meets the novelty requirement but not the unobviousness requirement. For example, a chemist combines two existing chemicals to produce a blend that is useful as a coolant. The blend is novel as long as there is not a previous provisional or regular patent application on file for the blend and the blend is not disclosed in a single piece of prior art. However, if a scientist of ordinary creativity (i.e., a PHOSITA) could have come up with the idea to blend the two chemicals, based on multiple pieces of prior art, the blend is obvious.

Although it is rare, an invention that is unobvious can fail for lack of novelty where the invention is part of an unpublished patent application that was filed first. Secret knowledge or use of products and processes is not part of the prior art because the patent office only looks at *public* information on

which an inventor could have based her invention. A provisional or regular patent application can establish one person as the first inventor, even if no one knows that the application has been filed. For example, Inventor #1 files a provisional patent application on a novel method for purifying water that is unobvious in light of all prior patents, publications, and other documentation that could serve as prior art. During the provisional period, Inventor #2 files regular patent application on an identical process for purifying water that he developed on his own. Inventor #2's application cannot be obvious because Inventor #1's provisional application has not been published and thus is not in the prior art. Inventor #2's application, meets the unobviousness requirement but fails based on lack of novelty. The situation would have played out identically if Inventor #1 had filed a regular patent application but the regular patent application had not yet been published. For this to be true, Inventor #2 must have filed his patent application within 18 months of when Inventor #1 filed hers.

Instances in which an invention is unobvious but is not novel are rare, because it is improbable that two inventors will develop identical inventions so close in time. However, it is possible that such a situation could occur where a pressing problem causes many inventors to work on solutions. In the example above, Inventors #1 and #2 may have both been inspired by their concern about unsafe drinking water following a natural disaster or civil war that received a lot of media coverage.

5.4.3.8. Why We Need Unobviousness. Some people, usually technical people, think that utility and novelty ought to be sufficient for patentability, and unobviousness is an unnecessary requirement. However, this view is irreconcilable with the Constitution, which wisely demands that an invention must promote the *progress* of technology. Suppose that a patent claims a reaction that has to be run between 60°C and 70°C to yield 50 percent conversion. Another person runs the reaction at 80°C and gets 90 percent conversion. No doubt this person has utility and novelty, but would you grant him a patent? Would such a patent promote science? We think not. Consider a new shape for a water bottle or perhaps a new shape of eyeglasses, neither of which improve functionality. Such would lack utility, although they may be novel. We conclude that patents granted merely for usefulness or novelty would not promote science and, therefore, would not be good for society.

5.4.3.9. Summary of the Invention Content Law. Figure 5.4 summarizes the stages the invention must pass through on the road to patent. As this flow chart suggests, inventions do not have to be “better,” but the law requires that they must be useful, novel, and unobvious.

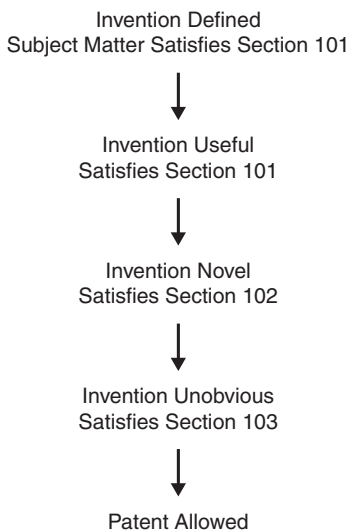


FIGURE 5.4. Required steps to obtain a patent.

5.5. THE SECOND LAW OF INVENTING

The second law of inventing, which we refer to as the “*invention process law*,” summarizes the steps one must take for creating a patentable invention. The following equation defines the two steps on the road to patent:

$$I = C + R_p$$

where I is invention, C is conception, and R_p is reduction to practice. In other words, the inventor first recognizes a need (C) and then proceeds to fill it (R_p). We will now discuss these concepts.

5.5.1. Conception

In 1987, a federal court defined conception:

The conception of the invention consists of the complete performance of the mental part of the inventive act. All that remains to be accomplished . . . belongs to the department of construction not invention. It is, therefore, the formation in the mind of the inventor . . . of the complete and operative invention

The first sentence beautifully states the essence of conception, the complete mental visualization of the invention. However, in light of the modern world of

inventing, the rest of the quote is somewhat obsolete. In contemporary institutions, both industrial and academic, research (“invention”) and development (“department of construction”) are intimately coupled. It is often difficult, if not impossible, to separate research and development. And inventions often originate during development.

Conception (see Figure 5.5) may come in a flash or may be the result of years of research. For conception, the inventor must have an idea of the complete and operative invention, albeit the final product may be modified and improved for commercialization. What is essential is a disclosure that enables an ordinary scientist or engineer (“a person having ordinary skill in the art”) to reproduce the invention without additional experimentation. Conception also requires corroboration—that is, proof that the idea that was disclosed



FIGURE 5.5. Conception—it begins with an abstract idea.

actually produces a workable invention. (See Chapter 9 for examples and more details on conception.)

5.5.2. Reduction to Practice

Reduction to practice is a legal term, which means that the inventor demonstrated that the invention is performing as visualized in conception. A composition of matter (say, a chemical compound) is reduced to practice when it is synthesized and characterized and after its use is demonstrated. A process is reduced to practice after the various steps of the process are tested.

Reduction to practice can be *actual* or *constructive*. In actual reduction to practice, the inventor performs experiments, collects data, and demonstrates that the invention is operational to support a patent application. For example, an inventor that conceives the idea for a device that rotates at a precise speed to keep particles suspended in solution and then proceeds to build a prototype showing that such a device works has actually reduced the invention to practice. Actual reduction to practice is particularly important in well-established crowded disciplines where the inventor has to show unexpected or surprising improvement over the prior art.

In constructive reduction to practice, the inventor files a (provisional or regular) patent application that contains sufficient detail to enable a technical person of ordinary skill to reproduce and use the invention without additional experimentation, but the inventor has not made the product or used the process yet. In constructive reduction to practice, the inventor does not have to carry out experimentation but can use prior art references to convince the patent examiner that the invention will be feasible. For example, if the inventor above draws precise diagrams for how to build her rotating suspension device, then files a patent application immediately to protect her invention, she has constructively reduced to practice. In this connection, let us discuss the prophetic patent.

5.5.3. The Prophetic Patent

Situations may arise when an inventor has a great idea but has no time for lengthy experimentation or time-consuming data collection. For example, an inventor may have an idea for the preparation of a new chemical, polymer, or enzyme but does not have weeks or months, or does not have the money for an expensive piece of characterization equipment, to experimentally demonstrate synthetic feasibility. In such instances, the filing of a prophetic patent application may be the solution.

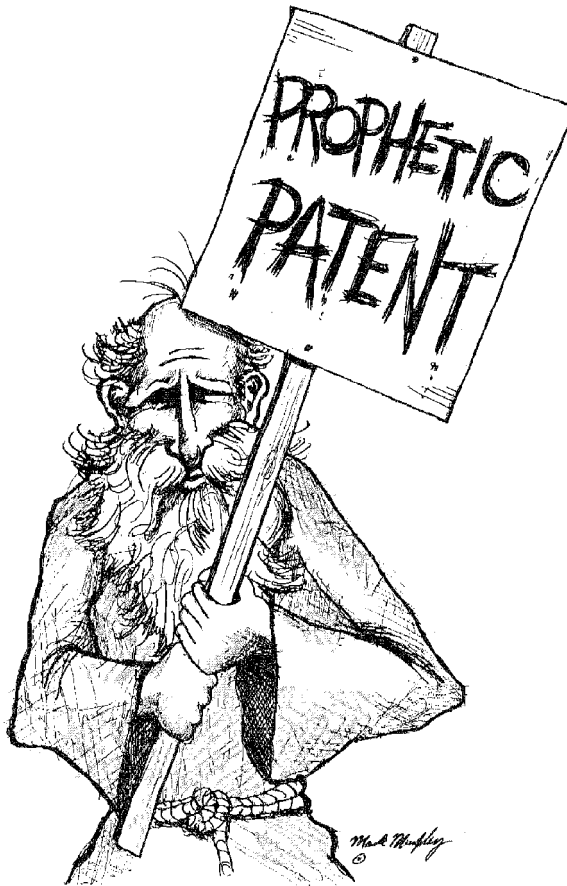


FIGURE 5.6. The prophetic patent.

A prophetic patent application can be filed if the specification contains sufficient information to teach others how to practice the invention and there is reasonable expectation for the success of the invention.

A prophetic patent (see Figure 5.6) is granted for inventions that have not been actually (physically) reduced to practice, provided that the application contains sufficient details for technical people to reproduce and use it. In a prophetic patent application, the inventor describes how to make and use his invention but does not provide *working examples*, meaning actual examples that have been carried out in the laboratory or workshop. The application may contain one or more *prophetic* (also called “paper”) *examples* and *prophetic claims*. Not to mislead the reader, the specification of prophetic patents must be written in the present tense. If the patent examiner doubts a prophetic claim, she can demand experimental proof for it.

After the prophetic application has been filed, the inventor typically has one to two years to carry out research to collect experimental data. When the hard data have been collected, the prophetic application can be replaced with a continuation-in-part application (see also Section 6.5) containing the new data. Depending upon what was disclosed in the prophetic application, the continuation-in-part might be entitled to the same priority date as the prophetic application.

In practice, it is not too difficult to obtain prophetic patents on mechanical or electrical inventions, because reading a blueprint of a machine or drawing a circuit is rather straightforward and can convince the examiner that the machine or circuit will work as claimed. It is more difficult to obtain prophetic claims for chemical and polymer inventions, and it is most difficult for pharmaceutical or biotechnology inventions. After all, it is exceptionally difficult to predict without extensive experimentation whether a new chemical or polymer can be synthesized or whether a drug or enzyme will be effective. Pharmaceutical and biotechnology inventions are often said to be *unpredictable arts*, which means the usefulness of inventions in those fields is less readily known. As a result, the PTO requires that more information be disclosed in patents for inventions in the unpredictable arts and is more likely to closely scrutinize a patent application for supporting experimental data that prove assertions made in the patent. By contrast, mechanical and electrical inventions are *predictable arts*. Patents in these fields will be granted even without supporting experimental data or a patent application that specifically spells out each step of making or using the invention.

In a sense, every patent is prophetic because, no matter how precisely you describe your experiments and observation, others who will repeat it may not get exactly the same results. Your claim that someone else will get exactly the same results is in fact a prophecy.

5.6. THE STRUCTURE OF THE PATENT DOCUMENT

This section will acquaint you with the parts of today's patent. While the form of patents underwent a lot of changes over the years, currently we distinguish three major parts: (a) the cover sheet, (b) the specification, and (c) the claims.

5.6.1. The Cover Sheet

The cover sheet (or first page) of a contemporary patent contains a great deal of information: some essential to technical people, some of significance only to patent professionals. We will discuss the former and only touch upon the latter.

United States Patent [19]**Kennedy et al.**[11] **Patent Number:** 5,242,983[45] **Date of Patent:** Sep. 7, 1993

- [54] **POLYISOBUTYLENE TOUGHENED
POLY(METHYL METHACRYLATE)**
- [75] **Inventors:** Joseph P. Kennedy; Gretchen C. Richard; Michael J. Askew, all of Akron, Ohio
- [73] **Assignee:** Edison Polymer Innovation Corporation
- [21] **Appl. No.:** 854,421
- [22] **Filed:** Mar. 19, 1992
- [51] **Int. Cl.²** C08F 255/10; C08L 33/12; A61F 2/28
- [52] **U.S. Cl.** 525/309; 525/227; 525/319; 525/903; 526/329; 526/348.7; 623/16
- [58] **Field of Search** 525/227, 309, 319, 903; 526/329, 348.7

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Primary Examiner—Vasu S. Jagannathan
Attorney, Agent, or Firm—Louis J. Weisz

[57] **ABSTRACT**

A bone cement is prepared by synthesizing a polymeric composition comprising poly(methyl methacrylate) cross-linked by copolymerization with tris(ω -methacryloyl) polyisobutylene. A powder is formed from the composition, and the final cement is prepared by mixing the powder with additional methyl methacrylate in the presence of a catalyst to form a dough-like material that is polymerized in situ to yield a cement useful for orthopedic purposes. Preferred embodiments employ tris(ω -methacryloyl) compounds within a particular molecular weight range, and which are present in the powder in particular amounts relative to the poly(methyl methacrylate) component therein.

5 Claims, 4 Drawing Sheets**FIGURE 5.7.** The cover sheet of a patent.

Figure 5.7 shows the cover sheet of a representative patent. The information on the top (above the horizontal solid line) is intended to identify the patent. The mysterious numbers in brackets are called INID Codes (Internationally agreed Numbers for the Identification of Data), which convey information that can be understood by patent offices in countries throughout the world. For example, the [19] in front of United States Patent shows that the United States is the issuing country. For the most part, these bracketed numbers are the PTO equivalent of the "For Office Use" only sections on forms, to which we have all become so accustomed. The first entry under the horizontal line

is the title of the patent [54], and underneath are the names and residences of the inventors [75]. Under this is listed the assignee [73], who is the owner of the patent rights. Often, the inventor gives his employer ownership of his invention through contracts he signs when he is hired. If this occurs, the patent owner will be the employer while the team of employees, who actually made the invention, will be the inventors. (See Chapter 10 for more details on patent ownership.)

Next comes [21], the Application Number (often called the serial number) assigned to the application by the PTO. The Application Number is a unique identifier for the patent, much like a social security number that identifies an individual U.S. citizen. No two patents have the same Application Number. The filing date [22] shows the date of filing. The patent would ordinarily expire 20 years from this date.

Among the subsequent numbers we mention only [56] and [57]: References Cited and Abstract. The former lists the patents and publications that the inventor is providing to the examiner. The inventor has a duty to disclose any prior art that she thinks has bearing on her application to the PTO. The patent examiner evaluates References Cited and other prior art the examiner uncovers to determine whether a patent should be granted. The Abstract is a brief summary of the invention, which gives a short description of the invention and how it works. The Abstract of a patent is similar to the abstract of a technical publication and should be familiar to science and engineering students. The only difference between an abstract for a technical publication and a patent is that the abstract of a patent may not exceed 150 words, whereas there may not be a word limit for an abstract for a publication. Scientists and engineers generally have no trouble writing the Abstract that will be used in their patent application. Below the Abstract is a line showing the number of claims and drawing sheets.

5.6.2. Specification

The specification's contents are spelled out in Section 112 of the Patent Law:

The specification shall contain a written description of the invention . . . in such full, clear, concise, and exact terms as to enable any person skilled in the art . . . to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The key word in the first sentence of Section 112 is to *enable*. The specification must enable (provide supporting details) so that technical persons can reproduce (i.e., “make and use”) the invention: If the patent isn’t enabling, it is invalid. You must make sure that you have given sufficient details in your specification so that a professional can reproduce your invention. Indeed, the fundamental difference between a technical publication and a patent is that a publication teaches an idea, develops a hypothesis, and supports it with experimental data, whereas a patent teaches technical people how to implement and use something that is new and unobvious (i.e., the invention).

The specification describes the invention in detail, together with variations of its use. It contains a hypothesis relative to the utility of the invention and provides instructions on how to perform and use the invention. The specification cannot be changed (except for obvious errors, such as typos) after the application is filed.

The specification is directed to both technical people (those “skilled in the art”) and lay people. Parts of the text of a specification and scientific publication are frequently identical. Its language is technical; nevertheless, it must also be understandable to the layperson (the judge). As a consequence, the specification may be more readable than a scientific or engineering journal article. Indeed, the specification is a technical paper *and* a legal document rolled into one.

The PTO has strict rules as to what elements the specification must contain—that is, a title, background of the invention, references to related applications, detailed description of the invention, and drawings (when necessary). The background typically consists of two parts: (1) a criticism that notes shortcomings of the prior art and the field of invention and (2) a description of how the invention is different and distinguishable from the prior art. Graduate students in the sciences and engineering should have little difficulty in writing the background and the detailed description, parts that are very similar to the background and results-and-discussion of technical publications. The complete list of requirements is very long, but is readily accessible online from the PTO (“A Guide to Filing a Utility Application”).

Another essential requirement to include in the specification is the *best mode* to carry out the invention known to the inventor at the time the application is filed. It is not required to identify the best mode, but it must be included in the specification. You can try to conceal your secret by including it among many other examples (*embodiments*) and not identifying it, but you must include it. In practice this means that one of the examples among the many must be the best mode. The examples demonstrate embodiment of the invention and show that the inventor had *possession* of the

invention. Examiners may refuse to grant a patent for lack of a best mode. However, under the 2011 America Invents Act, if a patent application does not include a best mode (and the examiner fails to spot the omission), the lack of a best mode is not grounds for invalidating a patent that has already been granted.

When you (or your patent attorney) write the specification, the guiding principle must be that every part of the specification is drafted with the claims in mind—that is, to provide foundations for the claims. If you disclosed something in the specification and did not claim it, you have given it as a gift to the public.

5.6.3. Claims

The claims are the heart of the patent; they define the scope and boundaries of the invention. The claims state the legal rights of the patent owner. The specification describes the invention, but the claims define the exclusive rights of the inventor (or the assignee). Like the fence around a piece of land, the claims are the boundaries of a patent. A claim is property: It can be bought, sold, or rented (licensed), and it is the means by which the invention is separated from the public domain.

Claims are single sentence statements, which legally define with great precision what the inventor regards as the invention. The claim must state what is new. The second sentence in Section 112 (see above) spells out the legal requirements for a claim.

There are three types of claims: (a) composition of matter (or product), (b) method (i.e., process), and (c) product-by-process. A composition of matter claim is often the most valuable type of claim, because it protects the composition (product) so long as the patent is in force. A method (or process) patent, on the other hand, protects only the way a product is made, meaning that if someone discovers another process for making the same product, he will be free to put it to use and exploit it. A product-by-process claim is a disguised product claim, that is, “The network comprising the reaction product of A and B . . .”, meaning that it claims a product in terms of a process or method of manufacture.

The specification and claims are inseparable; they are essentially one unit. The specification supports the wording of the claims; indeed, it is a dictionary used to interpret the claims. The language of the claims is crucial, and we strongly urge you to seek the help of an experienced patent attorney to construct the claims. It is a sad fact that the large majority (about 95 percent) of today’s patents are worth very little. Most of the revenues generated by patents come from a small percentage of them. And one of the important

reasons that patents may be unprofitable is because the claims have not been constructed to their full potential.

The length of the claim (the fewer words it contains) is independent of the breadth of the coverage. However, additional words in a claim, beyond the basic claim, tend to reduce its breadth and diminish the rights of the inventor. For example, a simple claim, say “a motorcycle,” would be enormously broad (and valuable) because no one else would be allowed to make, use, sell, or import a motorcycle except the inventor. The addition of just one word to this claim, say “a red motorcycle,” would severely restrict (narrow) the claim.

Claims can be independent or dependent. Each patent must have at least one independent claim. Every independent claim is separate and distinct, and stands alone on its own merit. The independent claim may be followed by dependent claims that modify and restrict the scope of the independent claim. Like the branches of a tree, a (narrow) dependent claim refers to another (broader) dependent claim, which in turn refers to another (even broader) dependent claim, until they trace back to an independent claim. If the independent claim is not infringed, a dependent claim cannot be infringed; however, if a dependent claim is infringed, an independent claim can still remain untouched. Figure 5.8 depicts the claims section of a typical patent.

- What is claimed is:
1. A polymeric composition comprising poly(methyl methacrylate) cross-linked with a telechelic compound having a number average molecular weight from about 6,000 to about 25,000, and a maximum molecular weight distribution of about 1.5, selected from the group consisting of tris(ω -acryloyl) polyisobutylene and tris(ω -methacryloyl) polyisobutylene.
 2. A polymeric composition according to claim 1 wherein said telechelic compound is tris(ω -methacryloyl) polyisobutylene.
 3. A polymeric composition according to claim 2 in which tris(ω -methacryloyl) polyisobutylene constitutes about 5 to about 30 weight percent of said composition.
 4. A polymeric composition according to claim 2 in which the number average molecular weight of said tris(ω -methacryloyl) polyisobutylene is from about 15,000 to about 20,000.
 5. A polymeric composition according to claim 4 wherein said tris(ω -methacryloyl) polyisobutylene comprises about 15 to about 20 weight percent of said composition.

* * * * *

FIGURE 5.8. The claim section of Patent No. 5,242,983 for polyisobutylene-toughened poly(methyl methacrylate).

In the patent for polyisobutylene toughened by poly(methyl methacrylate) the only independent claim is Claim 1. Claim 2 is dependent on Claim 1. And Claim 4 is dependent on Claim 2.

The student is urged to pick up a patent, any patent, and identify an independent and a dependent claim.

CHAPTER 6

HOW DOES THE PATENT PROCESS WORK?

Suppose you conceived a great idea for a product, tested it experimentally, and reduced it to practice, and now you are ready to protect (i.e., patent) it. What must you do to patent your invention? The purpose of this chapter is to help you along the road to a patent. Just as you became aware of how simple it is to invent, provided that you know a few basics (see Chapter 5), now we want to teach you how simple it can be to obtain a patent (provided you really have made an invention).

A major practical difference between the acts of inventing and protecting an invention is that inventing can be done alone by you, the technical professional, whereas patenting generally requires the help of a patent professional (i.e., a patent attorney or patent agent). Patent law and PTO rules may seem byzantine in that they are complex, intricate, and procedurally dependent. You should have someone to hold your hand while you navigate toward a patent. Your job is to provide the ammunition (i.e., a written record of your invention) and to educate your patent attorney (or agent) as to the technical minutiae needed for a patent application. Subsequently, with the attorney's or agent's help, your goal is to convince the examiner that you have indeed fulfilled the requirements for a valid patent.

6.1. THE NOTEBOOK

Most importantly, you must document your invention. This means you must record in a notebook your conception, experimentation, and reduction to practice clearly and understandably for those who may examine it. Your notebook should be a diary of your invention in which you record everything that relates to your invention, such as your theories, sketches, experimental facts, observations, comments of others, receipts for purchases, correspondence, conclusions, and so on. However, you should avoid negative comments concerning the project, such as “this experiment did not work,” because they may come back to limit you. You should also avoid comments reflecting the utility or quality of the results of your research. It is preferable to state the data results rather than to draw interpretive conclusions. Photographs, analytical data, and testing results obtained by others should be permanently attached (glued or pasted in your notebook) and their origin referenced. If you need to delete something, do not erase, just cross it out. Do not leave large empty places and do not skip pages.

Under the old first-to-invent system, the notebook was crucial for establishing your date of invention. A notebook is still useful under the first-inventor-to-file system to establish that you are an inventor—that you independently developed the invention rather than deriving it from someone else’s work. The notebook may also prove useful in providing supporting documentation for the patent examiner.

Situations may arise (e.g., during infringement suits or derivation proceedings) where your notebook may be introduced as evidence and examined by adversaries. If you keep this in mind, you will know how to manage and organize your notebook. Here are a few tips: Your notebook should be permanently bound with consecutively numbered pages and lines at the bottom for dating and signatures. Loose pieces and sheets are unreliable to prove events and dates. Entries should be in ink, in chronological order, and you should sign and date each page. Critical entries must be witnessed and dated by at least one person who would understand your entry (i.e., would not be merely a “signature witness,” like a notary) and, if needed, could provide corroborating testimony. Your witness must not be a co-inventor or your patent attorney. If the witness is a fellow graduate student or lab mate, make sure you explain that the entry they sign is confidential. A dated and witnessed statement of reduction to practice is of particularly great value in the course of derivation proceedings (see Section 5.4.2.2).

6.2. THE PROVISIONAL PATENT APPLICATION

In 1995, in order to harmonize U.S. patent procedures with international (mainly European and Japanese) practices, a new rule was added

to the Patent Law: the provisional patent application to lock in the filing date.

First a warning: The term “provisional patent application” is a misnomer if there ever was one. The provisional application is by no means an “application” but an interim document that establishes the inventor’s priority to invention, provided that a regular patent application is filed within one year. The provisional application is not examined and expires after one year; in other words, the PTO doesn’t do anything with the provisional application except keep it on file. The provisional patent application is and remains secret. It is not published like a regular patent application, which is published 18 months after it is filed with the PTO. The actual document is rather simple; it describes the invention clearly and fully, but no claims, abstract, summary, or background will be needed!. It must be sufficiently detailed to enable technical people to repeat and use the invention and must include the best mode. The best mode is the best experimental condition the inventor has found to carry out the invention at the time the application is filed.

A provisional patent application provides important advantages to the inventor. The greatest advantage is that it proves completion of invention, so that after filing, the inventor is free to publish or lecture on his invention. This freedom to disclose and discuss an invention is, of course, most welcome to academic researchers. With a provisional patent application in their possession, they can start to look for, and have one year to find, licensing opportunities before they must decide whether to file a regular patent application. Furthermore, the very low filing fee of a provisional application (\$220 for large businesses and \$110 for small entities at the time of this writing) is most welcome to inventors of modest means. This could be particularly advantageous to some academic and independent inventors who tend to have modest funds for research and patenting. We learned, by frequent personal contact with many talented Eastern European academic researchers and inventors, that their governments do not provide adequate funding for research and provide none for protecting inventions. Consequently, they publish their findings to attract funding and keep their research going; however, in the process they may lose their chance for “promoting the progress of the useful arts” through patents. It would behoove these inventors to file an inexpensive provisional patent application in the United States (U.S. patent law makes no discrimination with respect to citizenship of the inventor), which then would give them a year to look for industrial sponsors. In contrast to regular patent applications, which must be written in English, provisional applications can be filed in any language.

Another great advantage of a provisional patent application is that it may relieve the inventor of lengthy or costly experimentation to prove invention until a regular patent application is filed. Circumstances may arise when, for one reason or another, the inventor is unable to perform long and expensive

experimentation or doesn't have the funds for specialized equipment to test the invention. In such instances, a well-crafted provisional patent application may be of great help until the one-year provisional period expires (see also Prophetic Patents, Section 5.5.3).

A further advantage of filing a provisional patent application is that it delays, up to one year, the expiration date of a patent, because the 20-year patent protection period starts with the filing date of the regular patent application. After the patent has been issued, the filing date of the provisional patent application will be the patent's priority date (i.e., the date of invention to be compared with prior art).

One can file several provisional patent applications and later combine them into one regular patent application. Such a situation may arise during a long or complicated research project or during the writing of a Ph.D. dissertation.

Last but not least, the filing of a provisional patent application gives the right to advertise an invention as "patent pending."

6.3. THE (REGULAR OR NONPROVISIONAL) PATENT APPLICATION

The patent application document is first of all a valuable teaching instrument. It describes an invention clearly and in detail so that technical people skilled in the art can duplicate and use it without additional experimentation.

Specifically, the application consists of a petition, specification (with drawings if needed), claims (see Section 5.6), an oath (that the inventor believes he or she is the first and original inventor), and fees, which depend on the length of the specification and the number of claims. These items must be prepared following exactly the requirements of the *Patent Law* (U.S.C. 35), the *Patent Rules of Practice* and the *Manual of Patent Examining Procedures* (see Figure 6.1). The latter, the "bible" of patent examiners, patent attorneys, and patent agents, is a guideline and reference work on procedures and practices of well over 2000 pages. These three key documents are freely available online from the PTO.

A well-crafted patent application first describes accurately the background of the invention and the problems the inventor grappled with to complete the invention. The introductory section cites the entire relevant prior art the inventor is aware of and discusses how the invention overcame the various shortcomings of the prior art. Subsequently, it presents a succinct summary of the invention highlighting its advantages. After this introductory section the application describes in detail, typically by the use of numerous examples, the best mode for carrying out the invention. One of the examples must describe the invention in detail so as to enable an average technical person (i.e., a person of ordinary skill in the art) to reproduce and use the invention. The application

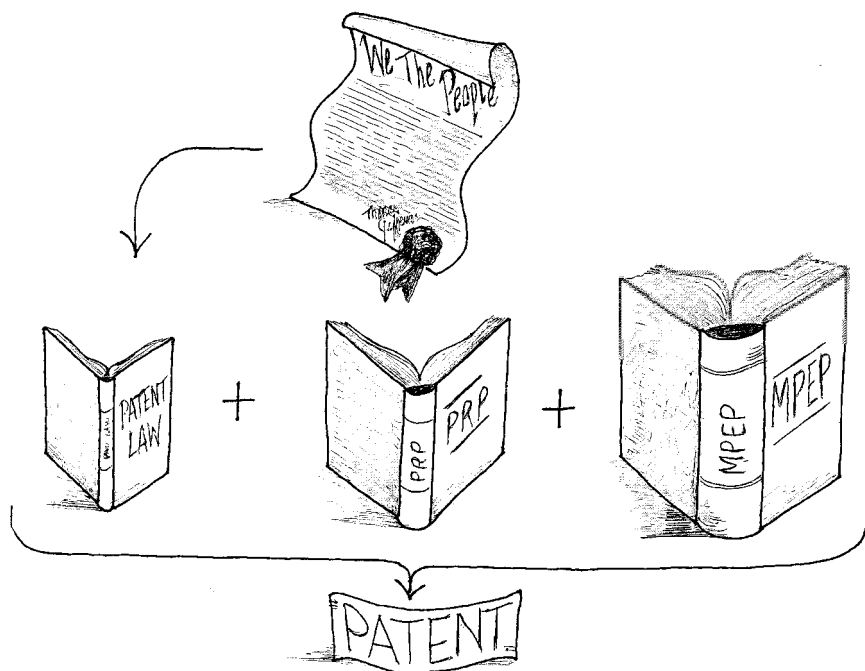


FIGURE 6.1. Key documents relevant to patents: The *United States Constitution*, which leads to Patent Law, the *Patent Rules of Practice* for attorneys, and the *Manual of Patent Examining Procedures* for patent examiners.

concludes with a series of claims, the most difficult part of the document. The claims are one-sentence definitions that clearly point out the subject matter the inventor regards as the invention, in the broadest possible terms.

The applicant must keep well in mind the enablement and best mode requirements of the Patent Law. Enablement means that the inventor must present detailed information to enable a person skilled in the art to reproduce and practice the invention without additional experimentation. The best mode requirement means that the inventor must describe the best conditions he knows for carrying out the invention at the time the patent application was filed.

In view of the numerous arcane rules and procedures of the PTO, it is best to have the help of a patent professional (i.e., a patent attorney or patent agent) for writing the claims and filing the application, as well as during prosecution of the patent. Prosecution is the process that one goes through to obtain a patent. Both patent attorneys and patent agents must pass the same patent bar examination to practice at the PTO. Patent attorneys and agents can both file patent applications and communicate with patent examiners, but only a patent attorney, who has a law degree, can represent inventors in

court. Academic researchers usually file their application with the help of their technology transfer office, whereas industrial employees have patent departments to assist with details.

Inventors have to educate their patent attorney or agent as to the technical intricacies of their invention and provide working examples. The inventor has to show the attorney how the invention is different from the prior art, or how it is superior to earlier inventions, and must be certain that the attorney understands the invention by asking him questions. The patent attorney's job is to evaluate the invention against the prior art, determine whether the invention is novel and unobvious, and construct claims that provide maximum protection of the invention. After the attorney has absorbed the technical information and details and finalized the examples, he prepares the first draft of the specification and claims. These must be carefully reviewed by the inventor to make sure the claims adequately cover the invention. A regular patent application must have at least one inventor in common with the named inventors of the provisional patent application in order to keep the provisional application's priority date. Finally, the attorney completes a variety of forms, assembles the needed items, and files the application with the PTO.

Be aware that the PTO will publish your patent application 18 months after it was filed, unless you file a *non-publication request* (NPR) with the application. The NPR states that you do not intend to file foreign applications and requests that the office not publish the patent application until the patent is granted. The 18-months publication statute was enacted to harmonize U.S. patent laws with those of foreign countries, so inventors can request that the 18-month rule not be followed if the inventor is only filing in the United States. When you read a published patent application, you do not have to worry about infringing the claims because they are still being prosecuted. Copies of your patent application can be obtained from the PTO or freely downloaded online. Your competitors, who most likely follow your patent activity, may become aware of your patent application publication and can cite pertinent prior art against it. If the examiner was unaware of such a reference, he can use it and, if he finds it relevant, may reject your application.

A most unpleasant consequence of the 18-months publication is that if the patent application is ultimately denied, the inventor will not receive a patent *and* has divulged his secret.

6.4. PROSECUTION: CONVINCING THE PATENT EXAMINER

While it is theoretically possible and permitted by law to file a patent application without the help of a patent attorney or agent, we strongly recommend that you seek professional help with prosecution.

Prosecution starts with filing the patent application at the PTO and ends when the patent is either granted or ultimately denied. Prosecution is essentially a thorough examination of the specification and claims by a patent examiner to determine whether the invention is useful, novel, and unobvious (for the definition of these terms, see Section 5.4). The potential commercial success of the invention is of no interest to the examiner. Furthermore, the examiner is keenly interested in anticipation, but not in infringement of an in-force patent; that is, he cares if the patent is obvious in light of the prior art, but does not care if there would be infringement if the inventor tried to make, use, or sell his invention (see also Chapter 7).

6.4.1. Starting the Prosecution Process

Prosecution starts with the application being cataloged and checked to make sure it meets the numerous formal requirements of the PTO. Then it is forwarded to the appropriate examining group (there are 17 such groups), thence to a specific “art unit,” and finally to an examiner, who will have responsibility for the application. There are about 6000 examiners in the PTO. In view of the enormous backlog of applications in the PTO (at this writing, there are some 718,000 applications awaiting examination), today’s inventors will have to wait some 25 months to receive the examiner’s first response (the so-called *first office action*) and can expect a total prosecution time of about four years. Interestingly, when Edison obtained his patent on the phonograph in 1878, his application was approved in a few weeks. The new America Invents Act, passed in 2011, aims to significantly speed up the patent process by introducing new procedures, giving inventors an incentive to submit the application online, and adding a short-term 15 percent surcharge that must be used to reduce the current PTO backlog. In special cases, a patent application may receive *accelerated examination* for a fee. For example, inventors 65 years or older, or those claiming advances in the treatment of cancer or AIDS, may request accelerated examination. The Director of the PTO also is permitted to expedite applications for inventions that he deems particularly important to the national economy or to U.S. competitiveness abroad.

The examiner starts with a review of the application that includes a search of the prior art, a formidable task. A patent search cannot ever be 100 percent complete; there will always be a chance that some prior art remains undiscovered.

6.4.2. The First Office Action

The first office action usually consists of a few pages of critical comments by the examiner, called *rejections*. This first office action typically contains

rejections of most of the claims because of lack of novelty or unobviousness. As novelty and unobviousness are defined by Sections 102 and 103 of the Patent Law, respectively, these rejections are often called 102- or 103-rejections. The examiner must state the reasons for each rejection and provide a list of references he used to reach the conclusion. The inventor/applicant, after having carefully studied the references cited against the claim, can either overcome the rejection by modifying (*amending*) the claim or acquiesce, in which case the claim is *abandoned*. If the examiner's rejection is based on novelty because the invention became public before the inventor filed a patent application, then the inventor can also overcome the rejection by *swearing behind* the invention. This means that the inventor makes an oath that he reduced his invention to practice on some date before the prior art reference. Most of the patent agent's or attorney's time will be spent evaluating the examiner's 102- and 103-rejections and formulating responses (*rebuttals*) to these rejections. It is the patent professional's responsibility to respond to the rejections, preferably with the inventor's input.

Besides rejection, the examiner can issue an *objection*, which signals problems with the language or form (rather than the substance) of the claim. The most common objection is *restriction*, which occurs when the inventor claims more than one invention in the application. The rule is one invention in one application. In such a case, the applicant must *elect* (i.e., choose), which claims to further prosecute. The rest of the claims may be abandoned or become the subject of a *divisional application* to be filed later but preserving the filing (priority) date of the original application. (See Section 6.5 for more on divisional applications.)

6.4.3. Allowances and Rejections by the PTO

In due course, the examiner reviews the applicant's amendment. If he accepts it, the patent is *allowed* and a *notice of allowance* is issued, which means that the claims satisfy the legal requirements of patentability. In the majority of cases, however, the examiner raises additional objections and cites further references that *read on* (i.e., cover) the claim and issues a *final rejection*. But do not despair, a final rejection is far from final. The applicant has several options: He can *amend* the claim for the second time (usually to narrow it), he can file a *continuation application*, or he can file a *request for continued examination*. A continuation application is a rewritten version of the original application with new claims, which can be used to overcome the examiner's rejection (see Section 6.5). A request for continued examination is a demand for continued prosecution after the PTO has issued a final rejection. This is not a continuation application, but rather a reopening of prosecution before the

same examiner over the same disputed claims. An inventor pays an additional filing fee to trigger the request for continued examination and gain the right to continue to argue her case with the patent examiner. Of course, the inventor can also abandon the claim at any time during prosecution.

During this phase of the prosecution the applicant's attorney may have direct discussions with the examiner in person or by phone regarding the details of the invention. These direct discussions help to clarify the invention and answer the examiner's questions without delay. If the examiner remains unconvinced and does not accept the changes in the claim, he will send an *advisory action* to the attorney restating his position. If the applicant believes the examiner is wrong, he can file an appeal to the Patent Trial and Appeal Board, an administrative tribunal of senior examiners. This Board is still in the PTO but is above the employment level of the examiner. The Board can either reject the appeal or accept the applicant's argument, in which case the claim will be allowed. If the claim is rejected, the applicant can file another appeal, this time to the Court of Appeals for the Federal Circuit—a court that specializes in patent law. And if this court also rejects the claim, the applicant can request the Supreme Court to review the case. However, the Supreme Court hears a *very* limited number of cases each year and normally only tackles patent cases that raise a new question of law, as do some cases in the fields of biotechnology and software.

In the final analysis, the patent application process, called *prosecution*, is like a negotiation in which the PTO, representing the public, and the patent attorney (or agent), representing the inventor, strike a deal, which defines the scope of the rights of the inventor without undue loss of public property. The aim of the applicant's attorney is to get a larger and broader collection of rights to exclude others for his client, whereas the examiner's aim is to enforce the law and to give away as little as possible of the public's property in return for the inventor's disclosure.

6.4.4. The Duty of Candor

The applicant is required by law to inform the patent examiner of all the pertinent facts, including experimental details and prior art relevant to the application. According to law, the applicant must disclose everything he thinks is important to deciding whether the claims should be allowed to satisfy what is known as the applicant's *duty of candor*. Generally, an applicant satisfies this requirement by filling out an Information Disclosure Statement, which lists all prior patents and publications that the applicant thinks might read on the patent. (See a facsimile of the document in Appendix 1.) If it comes to light that the applicant withheld relevant information or intentionally misled the

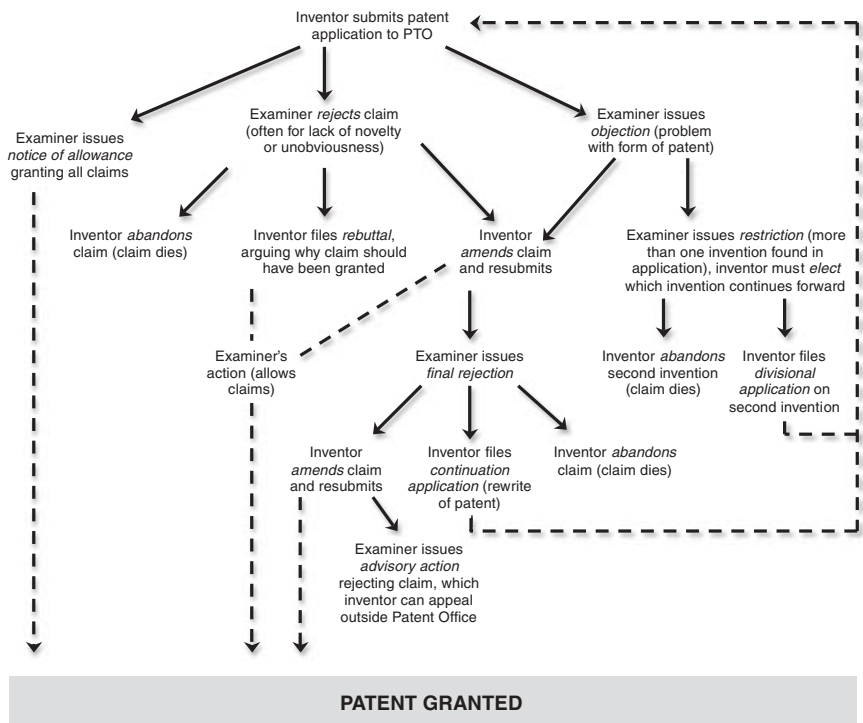


FIGURE 6.2. A summary of the patent prosecution process: It begins the moment an application is submitted to the PTO, includes all the possible variations that may arise during prosecution, and ends when the inventor is granted the patent or abandons his efforts. The dashed lines indicate that either a patent is granted or a new patent application is submitted.

examiner (i.e., the applicant committed *inequitable conduct*), the application is rejected or, if the patent is issued, it is declared invalid.

Figure 6.2 summarizes the prosecution process in graphic form. It contains all of the major elements and PTO procedures we have discussed thus far. The individual steps indicated in the figure have been explained in detail above.

6.5. CONTINUATION, CONTINUATION-IN-PART, AND DIVISIONAL APPLICATIONS

Science and technology never stop and the inventor may make unexpected or expected improvements or discoveries related to the invention during the months or years the application is being examined. But one of the PTO’s rules

states that once an application is filed, “new matter” (i.e., things not disclosed in the specification when the application was filed) cannot be added. What should the inventor do when new aspects of a filed invention come to light, improvements are made during prosecution, or a theory that was presented in the application is proven erroneous? The remedy is to file a continuation application, continuation-in-part application, or divisional application. Continuation applications are used for minor improvements and allow inventors to amend the claims of an earlier patent. Continuation-in-part applications cover major improvements where an inventor feels that he has to amend the claims and the specification of the earlier patent. Divisional applications are used when more than one invention is disclosed in a patent application. Let us discuss these items in greater depth.

6.5.1. Continuation Applications

Continuation applications are patent applications based on an earlier *parent application* and keep the parent application’s filing date and priority date. Continuation applications can be used in many situations, such as when potentially patentable subject matter was disclosed in the specification of a parent application but was not claimed. They can be used to claim new inventions an inventor learns of during his research, provided that these new developments are fully described in the specification of the parent application. Continuation applications can also be used as a tool in disputes with the PTO. If a patent examiner is willing to grant narrow claims on an invention, the inventor can temporarily abandon his broader claims, which will allow the patent to issue. The inventor can then quickly file a continuation application reasserting the broad claims and re-enter the prosecution process.

6.5.1.1. Differences Between Priority Dates and Filing Dates. At the outset, it is important to note that patent applications have two key dates listed on every application: a *filing date* and a *priority date*. The filing date is the date on which the application is filed, and the patent expires 20 years from the filing date. The priority date is the date the invention was disclosed and determines who was the “first-inventor-to-file.” For example, if an inventor files a provisional application on December 1, 2012 and a regular patent application on November 1, 2013, the priority date is December 1, 2012 while the filing date is November 1, 2013. Continuation applications have the filing date and the priority date of the parent application. Because of

the change in filing date, a patent filed as a continuation application lasts 20 years from the parent application's filing date. Thus, inventors who file a continuation application make a trade-off; they get an earlier priority date, but the life of their patent is shorter than it would have been had the continuation application been filed as a normal patent application.

6.5.1.2. Requirements for a Continuation Application. To qualify as a continuation application and thus keep the parent application's priority date, the application must be filed as a continuation that references the earlier application, must be filed while the parent application is still pending, must have at least one inventor in common with the parent application, and must contain only claims that are fully supported by the parent application. The first requirement is relatively easy to understand and merely explains that the cover sheet of a continuation application must state that what is being filed is a continuation of a particular, earlier-filed patent application (i.e., the parent application).

The other requirements are a bit more complex. A continuation is filed while the parent application is still pending if the parent application has not been abandoned by the inventor and there is at least one patent application based on the parent application pending in the PTO. For example, a parent application is filed on March 1, 2012 and continuation application #1 is filed on June 1, 2014, while the parent application is still wending its way through the PTO. On July 15, 2016, a patent is granted on the parent application, but the continuation application #1 is still being prosecuted. Then, on August 31, 2016, the inventor files continuation application #2, which is based on continuation application #1 and seeks to keep the earliest possible priority date. Continuation application #2 is essentially a continuation of a continuation, or a "child" of continuation application #1 and a "grandchild" of the parent application. The inventor may be entitled to the March 1, 2012 priority date of the parent application based upon its relationship to the parent application by way of continuation application #1.

The third requirement, that the continuation application must have at least one inventor in common with the parent application, sounds simple but is more complex in practice. Inventorship is based on who materially contributed to the invention described in the claims (for more details, see Chapter 9). The description found in the specification has no bearing on who qualifies as an inventor. For example, Inventor A and Inventor B develop a novel chemical compound for treating garden vegetables and a process for making this chemical. Inventor A conceived the idea for the chemical on her own and files for a product patent on the compound. A few months later, Inventor B, who was solely responsible for conceiving the idea for the process for making the chemical, files a patent application claiming the process. Inventor

B can file a patent application, but this application cannot be a continuation of Inventor A's patent because the two patents do not have an inventor in common.

The final requirement is that the claims of the continuation application must be fully supported by the parent application. This means that the specification of the parent application must enable an inventor to practice the claims in both the parent application and any continuation application. For example, an inventor files a patent application claiming a new machine that efficiently captures solar energy. Then, the inventor comes up with an idea for improving this machine by adding a few more parts that is unexpected and somewhat complicated. The inventor can file a patent application for the new invention, but the application probably cannot be filed as a continuation application because it is unlikely that the parent application explained how to use these additional parts in its specification.

In addition to the broad continuation application, there are two specific types of continuation applications that can be used only in special circumstances: continuation-in-part applications and divisional applications.

6.5.2. Continuation-in-Part Applications

The continuation-in-part application (or CIP) is a continuation application that contains additional disclosures that were not in the specification of the parent application and replaces the parent application. Through this filing, the inventor abandons the original application and files a brand new application, the CIP, which contains a portion or all of the original application *and* the new matter. Much like a continuation application, a CIP is only entitled to the priority date of the parent application if the specification of the parent application fully *enables* the invention claimed in the CIP. This means that the parent application's specification must allow someone skilled in the art to make the product or use the process claimed in the CIP. Filing a CIP is a gamble, because regardless of whether the CIP receives the earlier priority date, the CIP is always given the filing date of the parent application. Thus, CIPs have a shorter patent life, but only receive the benefit of an earlier priority date if the patent examiner determines that the parent application enables the CIP's claims.

What happens when further improvements or discoveries are made while the CIP is examined? The answer is: A second CIP can be filed. The second CIP will contain all or parts of the first continuation-in-part plus the new matter. And again, importantly, the second CIP may be entitled to the priority date of the original application. Theoretically, the process of filing CIPs may go on *ad infinitum*.

6.5.3. Divisional Applications

The *divisional application* is used when the parent application contains more than one invention. Patent Law dictates that only one invention can be claimed in each patent application. A patent agent or attorney will sometimes intentionally put more than one invention in a patent application for strategic reasons, such as to give the inventor more time to focus on research of claims that should be pursued. If an application contains more than one invention, the parent application moves forward with claims that relate to only one of the inventions and all other inventions become the subject of separate divisional applications. Divisional applications are a type of continuation application and may maintain the priority date of the parent application.

6.6. ALLOWANCE AND ISSUANCE

After the examiner is satisfied that the invention is patentable and the claims are properly constructed, the prosecution is concluded and a *notice of allowance* is issued. The inventor pays a final fee, and within about three months the owner of the patent receives the official patent certificate. All issued patents are published in the Official Gazette for patents, which is posted online each Tuesday at www.uspto.gov. The Gazette contains basic information and a representative drawing from each patent issued the previous week.

After the patent is allowed and issued, the history of the application is no longer a secret. At this point the *file wrapper* that contains all the numerous documents generated during the prosecution process of a patent is open to the public.

6.7. LOSS OF PATENT RIGHTS

While patents can remain in force for as long as 20 years, patent rights can be lost during the patent period for three major reasons: (1) failure to pay *maintenance fees* (also called *annuities*), (2) inequitable conduct during the prosecution or active life of the patent, and (3) discovery of prior art that proves the patent was not novel or unobvious.

During the term of the patent, the patent holder must pay maintenance fees to keep the patent in force. Failure to pay maintenance fees 3¹/₂, 7¹/₂, and 11¹/₂ years after issuance results in the cancelation of the patent. At this time, the maintenance fees for universities and small entities are about \$490, \$1240, and \$2055 respectively for these three time limits.

The PTO or a court of law can invalidate a patent if the patent holder has engaged in inequitable conduct that misled a patent examiner, such as failing to submit known prior art, misstating facts, or incorrectly naming the inventors on the application. In patent infringement suits, the allegedly infringing party will often try to prove that the patent holder engaged in inequitable conduct, which may invalidate the patent.

As with inequitable conduct, parties that have been sued for patent infringement will often try to invalidate the patent they are allegedly infringing by finding prior art that proves the patent is not novel or is obvious. Anyone can challenge the validity of an in-force patent during specified time periods by using two special PTO procedures (post-grant review and *inter partes* review), which are described in the next section.

6.8. CHALLENGES AND CHANGES TO ISSUED PATENTS

Even after a patent is granted, patent holders cannot be certain that the claims will not be invalidated. According to Section 321 of the Patent Law, two proceedings—*post-grant review* and *inter partes review*—allow others to challenge the validity of a patent that has been granted by the PTO. These proceedings are similar, but not identical. The PTO has also begun using a new proceeding called *supplemental examination* through which patent holders can disclose information to strengthen their patent or correct inaccuracies. We provide a brief summary of similarities and differences.

6.8.1. Post-Grant Review

Post-grant review proceedings can be initiated by anyone within nine months of the grant of a patent, except for someone who has already initiated a civil lawsuit challenging the patent's validity. In a post-grant review proceeding, a challenger can seek to invalidate a patent for such reason as lack of novelty in light of the prior art, insufficient written description, or failure to enable those skilled in the art to reproduce the invention. An exception is that a patent cannot be challenged for failure to satisfy the best mode requirement.

While anyone can file for post-grant review, the Patent Trial and Appeal Board (PTAB) will only initiate a post-grant review if the challenger shows that it is more likely than not that at least one claim should have been unpatentable. The patentee can refute the challenge by filing a written argument with PTAB. If PTAB finds the challenger's arguments compelling and allows the case to proceed, post-grant review works in a manner very similar to that

of a civil lawsuit. The patent holder and challenger must share documents and information with one another that support their arguments. (This is a great reason to carefully document research findings in a dated notebook.) The post-grant review proceeding can be settled out of court or the patent holder can agree to amend his claims in response to the lawsuit. If the patent holder and challenger cannot reach an agreement, PTAB hears arguments from both sides and then issues a ruling on whether the claims are patentable. Any claims found unpatentable are invalidated. Any claims found patentable are upheld and the challenger is prohibited from using these arguments in later post-grant review proceedings or patent infringement lawsuits. PTAB is encouraged to make the case quick—at least by legal standards—with all cases being decided within 1¹/₂ years from when the petition for post-grant review was granted.

6.8.2. *Inter Partes* Review

Inter partes review, a procedure very similar to post-grant review, can be used to challenge a patent after the post-grant review period has expired. However, *inter partes* review can only be used to challenge a patent on the basis of existing prior art, like patents or publications, not for any other reason.

6.8.3. Reissue Application and Reissue Patents

We are human, and humans commit errors. So what happens when, after a patent has issued, the inventor discovers a significant error in the specification, or becomes aware of a new reference that changes a key aspect of the patent, or concludes that the claims are too broad or too narrow? To correct such errors, the inventor can file a *reissue application* while the patent is still in force, although reissue applications seeking to broaden the claims must be filed within two years of the date the patent was issued. An inventor that seeks reissue must show that a patent is wholly or partly inoperative or invalid by reason of the error.

For reissue, the inventor abandons the original patent and files a new application with the same specification and new or modified claims. However, the PTO can only consider a limited number of factors in the reissue process. The PTO cannot look at new information during a reissue proceeding, which means that any new claims sought in reissue must stem from the description in the original specification. The reissue process includes a reexamination of the claims, a risk that has to be considered when deciding to file for a reissue application. Also of concern, the standard reissue process takes about five

years. Expanded claims are not valid until the reissue patent is granted, so companies that engage in a use or sale that will be infringing under the reissue patent cannot be held liable for uses or sales conducted before the reissue is granted.

The expiration date of the reissue patent will be the same as the original (abandoned) patent. A reissue patent is easily identified by its serial number, which starts with the letters “RE” followed by the digits of the series.

6.8.4. Supplemental Examination

Supplemental examination, a new process created by the 2011 Leahy–Smith America Invents Act, allows a patent holder to ask the PTO to consider, reconsider, or correct information relevant to an issued patent. Unlike reissue applications, supplemental examination cannot be used to amend the claims of the patent, but can only be used to bolster the information an examiner considers. The intent is that supplemental examination be used to strengthen a patent, such as by submitting new experimental data to more fully meet the enablement requirement or disclosing additional prior art that should have been considered before the patent was granted.

To institute a proceeding for supplemental examination, a patent holder must present information to the PTO that raises a substantial new question of patentability. This is a somewhat fuzzy standard that looks at whether a reasonable examiner would have considered the information to be important in deciding whether or not the claims were patentable. The PTO has not yet established specific procedures for supplemental examination, so it is not yet known what part of the PTO will conduct supplement examination or how long the process will take.

The most important role of supplemental examination is shielding patent holders from allegations of inequitable conduct (see Section 6.7). Through supplemental examination, a patent holder can make up for deficiencies or correct inaccuracies in the original patent filing, which could have led to inequitable conduct charges, provided that no charge of inequitable conduct has been previously levied against the patent holder. Information disclosed by the inventor for supplemental examination purposes cannot be used to later hold a patent unenforceable.

6.8.5. Summary of Post-Grant Proceedings

Table 6.1 summarizes the differences and similarities between post-grant review, *inter partes* review, reissue application, and supplemental examination.

TABLE 6.1. Post-Grant Proceedings

	Post-Grant Review	Inter Partes Review	Reissue Application	Supplemental Examination
Basis for challenging patent	Anything except best mode	Lack of novelty or unobviousness (prior art)	Significant error in the patent as filed	Anything relevant to the issued patent
Time to initiate review	Within nine months of grant of patent	More than nine months after grant of patent	Anytime, but expansion of claims must be filed within two years	Anytime
Requirement to proceed	More likely than not that one of claims is unpatentable	More likely than not that one of claims is unpatentable	Patent is wholly or partly inoperative due to error	Raises a substantial new question of patentability
Decision-maker potential outcomes	Patent Trial and Appeal Board (PTAB)	Patent Trial and Appeal Board (PTAB)	PTO Director	Unknown
	If challenger wins, claim is invalidated; if not, challenger cannot use the same arguments in later cases	If challenger wins, claim is invalidated; if not, challenger cannot use the same arguments in later cases	Amends claims of patent	Shields against charges of inequitable conduct

6.9. SUMMARY OF CHAPTERS 5 AND 6

Figure 6.3 is a flow diagram summarizing the essence of what we have covered in the last two chapters. The figure shows the key events needed to make an invention, along with the steps to patent an invention.

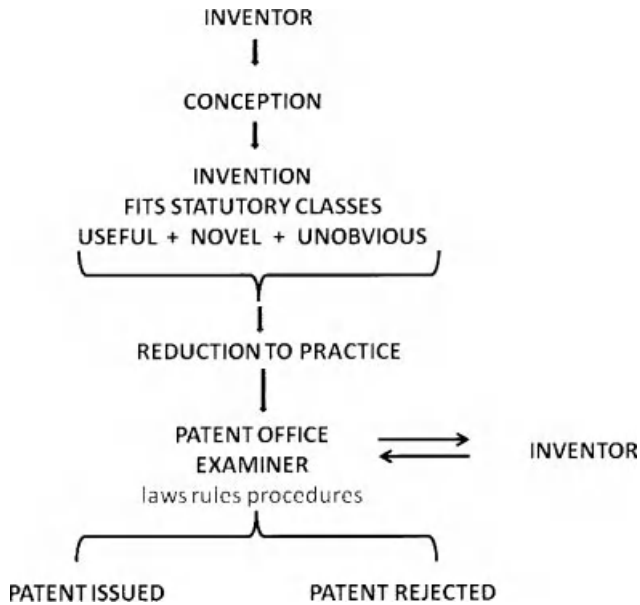


FIGURE 6.3. Key events for making an invention and obtaining a patent.

CHAPTER 7

INFRINGEMENT AND FREEDOM TO OPERATE

According to Section 271 of the Patent Law:

... whoever without authority makes, uses, offers to sell, or sells any patented invention, within the United States, or imports into the United States any patented invention during the term of the patent therefor, infringes the patent.

In other words, infringement of a patent occurs when someone (a person or company) makes, uses, offers to sell, sells, or imports a patented product or a product made by a patented process in the United States during the term of the patent without the patent owner's permission. A patent holder's permission is often granted in the form of a license, a legal contract that specifies which otherwise potentially infringing activities the other person can take. Just as a fence delineates the borders of a piece of land (real property), the claims define the borders of an invention (intellectual property). If someone invades by design or inadvertently the fenced area, he is trespassing and must pay a fine. The same is true with patents: If someone disregards the borders of the claims (i.e., makes, sells, uses or imports the claimed invention), he is infringing and must pay damages. An infringer need not have intended to invade another's rights to be liable for infringement. In fact, he can be liable

How to Invent and Protect Your Invention: A Guide to Patents for Scientists and Engineers, First Edition. Joseph P. Kennedy and Wayne H. Watkins with Elyse N. Ball.
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even if he did not know of the patent or sincerely believed his actions were outside the scope of the claims.

7.1. THE PARABLE OF THE KNIFE

Let us illustrate the concept of infringement with the parable of the knife. Assume that Emma invents the knife—a useful, novel, and unobvious thing—and she obtains a patent for it. Somewhat later, Charlie, who wants to carry a knife safely in his pocket, invents the pocket knife—that is, a blade that can be folded in its handle and unfolded when needed. This thing is also useful, novel, and unobvious, so Charlie also gets a patent claiming the pocket knife. Charlie thinks many people would like to have pocket knives and decides to manufacture his invention. Before moving ahead, he consults his lawyer, who advises him to consult a patent attorney. The patent attorney informs him that he cannot start making and selling pocket knives because Emma’s *generic* patent dominates (or blocks) his *specific* patent. If he would sell his pocket knives, he would infringe Emma’s knife patent and he would be sued for damages. But the attorney also tells him that he could make and sell his pocket knives, provided that he obtains permission (a license) from Emma for making and selling his invention. Thus, Charlie negotiates with Emma for her permission (i.e., a license, see Section 11.3) for making and selling pocket knives. Emma is willing to give her permission, but Charlie must pay royalties for her license.

Let us continue this parable by assuming that Eddie, who does not like to use two hands to slowly open his pocket knife, invents the switch blade—that is, a blade hidden in its handle from which it quickly pops out by pressing a small button on the handle. Eddie’s invention is also useful, novel, and unobvious, and he also obtains a patent protecting switch blades. But can Eddie make and sell his product? No, because his invention is dominated by Emma’s patent and by Charlie’s patent. Thus he has to obtain permission (a license) from *both* Emma and Charlie to start making and selling his switch blade. Again, Emma and Charlie are willing to license their patents to Eddie for payment of royalties. This parable is illustrated in Figure 7.1.

This parable further illustrates what we learned in Section 1.1, namely that the patent owner has the right to exclude others from practicing his invention, but, strange as it may seem, having the patent does not necessarily permit the patent owner to practice his own invention. It frequently occurs that a person or company has a dominating generic patent (claim) whereas another company has a specific patent; the company having the specific claim cannot practice the claim because the generic patent dominates it. On the other hand, the owner of the dominating generic patent cannot practice the specific claim

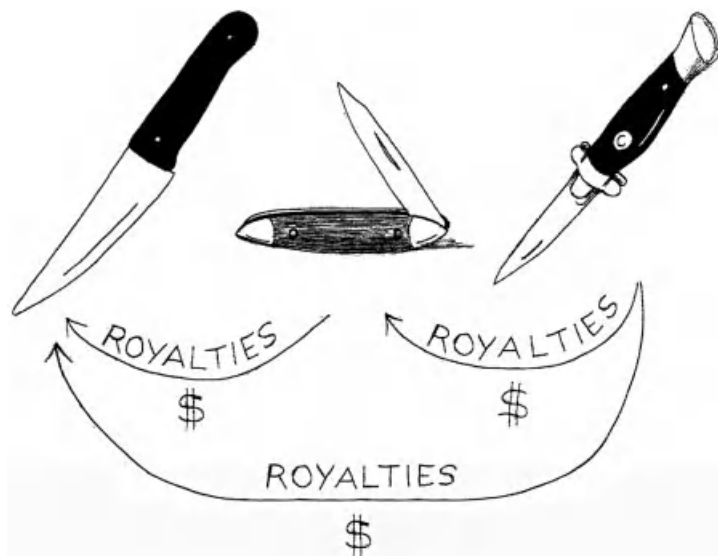


FIGURE 7.1. The parable of the knife. Patentable improvements require compensation to owners of the underlying patentable invention(s).

because it is also protected by patent. (These things are further discussed in Section 11.3 concerning licensing.)

7.1.1. The Story of Chlorobutyl Rubber

Closer to reality, consider the case of polyisobutylene, butyl rubber, and chlorobutyl rubber. High-molecular-weight polyisobutylene is an excellent rubber, but it does not retain its shape because it cannot be vulcanized. By introducing a small amount (1 to 2 percent) of isoprene into the polyisobutylene chain, the latter becomes vulcanizable. This latter rubber is an important all-purpose rubber, called butyl rubber, used, for example, as inner tubes in automobile tires. Butyl rubber, however, cannot be mixed with other all-purpose rubbers to obtain other useful blends. Some years ago it was discovered that, by lightly chlorinating butyl rubber (i.e., by introducing 1 to 2 percent chlorine in the butyl rubber chain), one obtains chlorobutyl rubber, which exhibits a series of surprising new properties, including enhanced miscibility with other all-purpose rubbers. Because of its miscibility with other rubbers, chlorobutyl rubber became the most important ingredient in automotive innerliners and revolutionized the tire industry. In the above scenario, polyisobutylene can be protected by a generic patent, which dominates subsequent patents for butyl rubber and chlorobutyl rubber. For the inventor of butyl rubber to make and

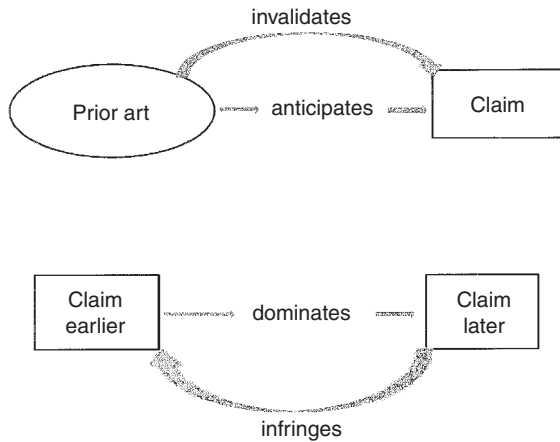


FIGURE 7.2. A claim anticipated by prior art is invalid. A subsequent claim dominated by a prior claim infringes the prior claim.

sell his invention, he would need a license to the polyisobutylene patent. For the inventor of chlorobutyl rubber to make and sell his invention, he must license the patents for both polyisobutylene and butyl rubber.

7.1.2. Anticipation versus Domination

People, even seasoned business people, sometimes confuse the concepts of *anticipation* and *domination*. In fact, these concepts have little in common. Anticipation occurs in connection with invalidation by a patent examiner, whereas domination is associated with infringement. Figure 7.2 helps to distinguish these concepts. Thus, in regard to anticipation: A claim is invalid if it was anticipated by prior art (i.e., if prior art reads on it). A patent examiner will not grant an anticipated claim. In regard to domination: If an earlier (prior art) claim reads on a later claim, the earlier claim dominates the later claim, and the later claim infringes the earlier claim. Both claims are entitled to patent protection.

The PTO only issues patents; it has no jurisdiction over and is not involved in infringement matters, which are handled by federal courts. A patent may infringe an in-force patent; however, this is of no interest to the examiner.

7.2. TYPES OF INFRINGEMENT

The patent holder must be his own policeman; that is, only he or his assignees can initiate legal action to stop the infringer and to collect damages. Infringement occurs when one makes, uses, sells or imports an invention

without authorization from the owner of a patent with claims that cover such activity.

Determining infringement requires careful reading of the claims of the patent and considerable legal expertise. Claim construction is a matter of law, and the exact wording of the claims has a direct bearing on the outcome of an infringement suit.

7.2.1. Literal (or Direct) Infringement

The law recognizes several types of infringements. If the claim literally reads on (covers, closely fits) the accused product (or compound, machine, or process), the product infringes the claim under the doctrine of *literal or direct infringement*. This type of infringement occurs if the infringing product contains *all* the components in at least one of the patent holder's claims. If the product contains all of the components of a patent holder's claim *and nothing more*, the product will always be infringing under the literal infringement doctrine. Products that contain more components than those claimed present a more interesting question, which requires us to look for specific language in the claim.

Open claims, which often state that certain elements "comprise" the invention, protect against any subsequent products, even if they contain extra elements. Put a different way, if the patent claims A + B + C (i.e., A, B, and C *comprise* the invention) and a later product contains A + B + C + D, the later product is infringing. *Closed claims*, which generally say the invention "consists of" certain elements, only protect against subsequent products that contain all of the components of the claim *and nothing more*. In this case, if an invention claims A + B + C (i.e., the invention *consists of* A, B, and C) and a later product contains A + B + C + D, the later product is *not* infringing. If the later product contained only A + B + C, it would be infringing. The PTO is more likely to grant patents for closed claims than for open claims. Closed claims are narrower, so they are more likely to be novel and unobvious, and they are easier to enable through patent disclosures.

7.2.2. The Doctrine of Equivalents

Even if the product, process, or composition of matter does not literally infringe the patent claims (meaning it does not contain the exact elements claimed in the patent), infringement can occur under the *doctrine of equivalents* if an infringer uses a very similar or equivalent material (or process) and tries to "invent around" the patent holder's claim to achieve the same result. The doctrine of equivalents may at first be confusing, because it is based on the literature of judicial decisions rather than a precise legislative statute.

The 1950 U.S. Supreme Court case, *Graver Tank & Manufacturing Co. v. Linde Air Products Co.*, provides an example. Linde Air owned a patent for an electronic welding process, and it sued Graver for infringing the patent. Graver argued that they were not infringing the patent because the patented welding process used a welding composition made of the alkaline earth metal silicate and calcium fluoride rather than the similar element Linde used, which was manganese. The court ruled that there was infringement based on a “doctrine of equivalents.” The court said that a party could not use a process exactly the same as one that is patented, but attempt to escape infringement by making some obvious substitution of materials. It was based on the rationale that the material performed substantially the same function, in substantially the same way, and yielded substantially the same result. The court opined that one reasonably skilled in the art would have known of the interchangeability of an ingredient not contained in the patent with one that was. Many scientists and patent attorneys disagree with this particular ruling, and, in practice, the doctrine of equivalents is not commonly used.

7.2.3. Contributory Infringement

Finally, one can be liable for *contributory infringement* if one assists others in infringement or persuades others to infringe. For example, an inventor has patented a process for manufacturing a novel polymer that requires the use of a specific preexisting catalyst. A company then begins producing the catalyst for use in the process and instructs other chemists on how to do the process with the knowledge that only a few of these chemists have actually licensed the rights to use the process. The company is liable for contributory infringement because it is assisting in and encouraging infringement by the chemists.

7.3. INFRINGEMENT SUITS

So what happens when a patent holder learns that someone is infringing her patent? To protect her rights, the patent holder must initiate an infringement suit. An accused infringer will typically try to defeat an infringement suit in two ways: (a) The accused infringer tries to invalidate the obstructing patent claim, and (b) he attempts to show absence of infringement. In order to invalidate a claim, the infringer will exhaustively reexamine every last shred of prior art and will leave no stone unturned, often by the use of expert witnesses, to find references that anticipate the claim (i.e., to destroy novelty) and to find prior art that teaches the subject matter (i.e., to destroy unobviousness). And the chances for finding relevant prior art that read on

the obstructing claim are not bad considering that patent examiners have only limited time and resources to ferret out every last thing that may read on the novelty and unobviousness of an invention.

Secondly, the alleged infringer will try to show that his actions were outside of the scope of the claims—that is, that he was not infringing the claims at all. He can do this by stressing differences between his product or process and the product or process described in the patent. This is where claims interpretation really comes into play, and broad *open* claims prove more valuable to patent holders than do narrow *closed* claims (see above).

7.4. WHEN TO SUE AN INFRINGER

In patent law, there is no fixed time limit—that is, there is no statute of limitation—for filing an infringement lawsuit. Nonetheless, courts will not allow a patent owner to sue for infringement if he waited for an unreasonably long time (say four to five years) to sue because waiting so long to file suit is unfair to the infringer. Courts award compensation equivalent to the damage caused by infringers, which is typically commensurate with royalty lost due to the infringement. If an infringer does not know he is infringing and a patent holder waits years to sue, the infringer could wind up owing millions of dollars in compensation (i.e., the cost of several years' worth of royalties) because of his ignorance. Courts may disallow an infringement suit if a patent holder waited years to file it in order to obtain more compensation from the infringer. On the other hand, if intentional (i.e., *willful*) infringement can be proven, the patent holder may recover triple damages plus attorney fees.

7.5. FREEDOM TO OPERATE

Before an inventor files for a patent, he will generally ask a patent attorney or agent to conduct a patentability search to determine if his invention meets the requirements of novelty, utility, and unobviousness needed to receive a patent. As we discussed above, an inventor can receive a patent even if a portion of his invention would infringe another person's patent if he tried to make, sell, or use his invention. He would still need authorization (a license) from the other patent owner to practice his own invention.

Freedom to operate looks beyond whether an invention can be patented. It looks at whether patent rights can be exercised without infringing on someone else's patent. Most companies that are looking to file for or license a patent conduct a freedom-to-operate survey, which looks at whether a potentially

patentable invention can be made, sold, or used without infringing on the patents of others. Given the approximately 250,000 U.S. patents granted each year, there is a reasonable likelihood that a patent owner's right to make, use, or sell his invention is constrained by other patents. Parties commercializing inventions want to reduce the number of licenses they must negotiate in order to market a new product, so they would greatly prefer to license an invention that is not limited by too many patents.

Freedom to operate may be more important to companies than whether an invention is patentable. Thus, a prudent inventor should consider both patentability and freedom to operate when assessing the viability of his invention. Often, a prior art search conducted to determine patentability will turn up the very patents that could present a problem regarding freedom to operate. Look beyond whether the invention is patentable and see if other, earlier inventions limit the ability to make, sell, or use the invention, as well as whether the owners of these earlier inventions are potential collaborators or hostile competitors.

Related to infringement and freedom to operate are two whimsically named concepts, *patent trolls* and *submarine patents*.

7.5.1. Patent Trolls

The term “patent troll” originates from a 1993 farcical educational video called “The Patents Video”; this video analogized a patent holder, who can charge a fee for others to use his patent, to a troll, who charges a fee to anyone crossing the bridge he lives under. While “patent trolls” could refer to any inventor or company who sues others for infringing on a patent, the term generally is used only to describe companies that have no intention of making, using, or selling the patented invention they own. Instead, the company aggressively enforces the patent by looking for infringers that it can sue to force a license agreement, settlement payout, or court case. Stereotypical patent trolls do not have the capability to produce the patented invention—they have no research staff, development department, or manufacturing facility. Instead, they buy patents originated by other companies through direct negotiations or through *patent auctions*. Patent auctions can come in two forms: Some companies electively auction off patents they are not using, but many other companies are forced to auction their patents during bankruptcy proceedings where a full patent portfolio can be bought at a bargain. Patent trolls threaten freedom to operate, because they may be willing to pursue lengthy legal battles, even if they are unlikely to win. Often, companies are forced to settle with patent trolls in order to move forward with their own technology development.

7.5.2. Submarine Patents

Submarine patents function much like the German U-boats during the Second World War. They are stealthy patents that remain “under water” until they emerge to threaten unsuspecting infringers. In the typical submarine patent scenario, an inventor files a patent application and allows other companies to begin producing infringing products before the application is published. As soon as the patent is granted, the patent holder can sue the infringer or force a more favorable licensing agreement by threatening an infringement suit. Submarine patents can be an issue for anyone producing a fast-paced high-tech product, because patents are not published until 18 months after they are filed. This means there may be thousands of “under water” patents upon which a new product might infringe. However, submarine patents were much more troublesome before 2000, because patent applications were kept secret until a patent was granted. Some companies would intentionally delay prosecution, hoping their patent would not be granted until some large corporation had unwittingly begun using their technology. If this occurred, the corporation would either have to immediately stop using the patented technology or begin paying a royalty to the patent holder. The terms of the royalty would be negotiated between the corporation and the patent holder, so the patent holder could demand a very expensive royalty.

7.6. PRIOR COMMERCIAL USE RIGHTS

One exception to the rule that the use of a patented product, process, or composition of matter constitutes infringement is *prior commercial use rights*. Prior commercial use occurs when a person or company makes, uses, or sells an invention and an unaffiliated inventor tries to patent the same invention. Under U.S. law, prior commercial use is a defense to infringement if the user used the invention either for an internal commercial purpose or for sale at least one year before the inventor disclosed the invention or filed for a patent. This may occur when a company is secretly making a product or using a process (to maintain it as a trade secret), and another person independently invents and patents the undisclosed product or process. Prior commercial use is almost always secret, because public uses of the invention would constitute prior art and destroy patentability.

7.6.1. Personal Defenses

Prior commercial use is a *personal defense* to infringement. Defenses protect the person that uses the defense from being sued for infringement. The defense does not mean that infringement did not occur; it simply means that the infringer had an acceptable excuse that prevents him from being held liable.

A prior commercial user has a right to continue using the invention, even though such a use would ordinarily be infringement. For example, Goodyear has been using a particular process for fabricating tires for many years and kept the process a trade secret. Bridgestone independently discovers this process and files for a patent. Goodyear can continue using the process, because it has a prior commercial use defense. As with many defenses, the person or company asserting prior commercial use must demonstrate that prior use has indeed occurred.

A *personal* defense can only apply to specific people or entities and cannot be sold, transferred, or used to defeat the patent holder's rights. In our case, prior commercial use can be asserted only by the person or company that made a previous commercial use of the invention (in the above example, Goodyear). While the prior user can continue using the invention free from the threat of infringement suit, he cannot license or sell the right to the invention. And the prior commercial use defense applies only to sites where the invention was used one year before disclosure. Returning to our example above, if Goodyear used the process at its Akron, Ohio manufacturing facility for the past five years but only began using the process at its Danville, Virginia facility six months ago, Goodyear could use the prior commercial use defense to continue using the process in Akron, but it would commit infringement if it used the process in Danville. Goodyear also could not license its rights to use the process in Akron to Michelin. It is important to remember that this defense does not in any way affect the validity of the patent as asserted against others. Bridgestone can still assert its patent against Michelin, even though Goodyear may have a prior commercial use defense against it.

7.6.2. Exceptions to the Prior Commercial Use Defense

There are three major exceptions that prevent a company from asserting the prior commercial use defense. First, this defense cannot be used against universities. Second, this defense does not apply if the use was derived from the patent holder. Thus, if Goodyear learned of the process from Bridgestone and began using it two years before Bridgestone disclosed it, Goodyear could not assert a prior commercial use defense. Finally, stopping a qualified prior commercial use can be considered abandonment that precludes future use. Thus, if Goodyear stopped using the process at its facilities four years before Bridgestone filed for its patent, Goodyear might not be able to assert the defense if it wanted to start using the process again.

Even this brief discussion of infringement indicates the complexity of infringement issues. This area of patent practice is extremely complex, and infringement lawsuits are extremely costly. They can easily run into hundreds of thousands or millions of dollars, so only companies with very deep pockets are able to sustain such suits.

CHAPTER 8

BIOTECHNOLOGY, COMPUTER SOFTWARE, AND BUSINESS METHOD PATENTS

Disruptive technology advances periodically change the way we live our lives. Advances in mechanical arts changed the face of American agriculture in the early twentieth century. During World War II, advances in engineering and physical sciences, such as the transistor and synthetic rubber, changed war strategies and results. Toward the end of the twentieth century, genetic engineering and molecular biology emerged as a new field of biotechnology, and computers and software created a whole new field of information technology. This chapter concerns the effect of patents on biotechnology and computer software, two fast growing areas of technology. It also tackles business method patents, another specialized area of patent law that frequently overlaps with software patents. Biotechnology, computer software, and business methods are unsettled areas of patent law because they do not fit easily into the Patent Law's subject matter and they are quickly and constantly changing. The sections below survey the development of patent protection in these fields with the understanding that new laws and court decisions will continue to impact the availability of patent protection for biotechnology, software, and business methods.

8.1. BIOLOGY MEETS PATENTS

8.1.1. The Supreme Court: Living Things Are Patentable

In 1980, the Supreme Court ruled by a narrow margin of 5 to 4 that “a live human-made microorganism is patentable.” This ruling is certainly among the most important decisions in the Court’s long history: It not only spawned new industries (e.g., biotechnology) but also started an avalanche of discussions on the meaning of life and controversial ethical matters. This ruling and its economic and ethical consequences are of immense importance to society at large, and we feel that students in the sciences and engineering should have some appreciation of these issues.

In the early 1970s, Dr. A. Chakrabarty, a microbiologist employed by the General Electric Company, developed a microorganism that was able to digest, and thus eliminate, crude oil spilled by tankers. At the time, several specific strains of *Pseudomonas* bacteria were known to digest individual components of crude oil (i.e., linear, aliphatic, cycloaliphatic, aromatic, and polynuclear aromatic compounds), but Chakrabarty wanted to create a single “super” microorganism that would break down and ingest all the components of crude oils. He reasoned that this could be done by fusing the genes of four strains of *Pseudomonas* bacteria. As he later explained, “I simply shuffled genes, changing bacteria that already existed.” After reducing his conception to practice, Chakrabarty (i.e., GE) filed a patent application on a genetically engineered new microorganism.

After several years of examination, the PTO allowed the claims related to the process of producing the new bacterium, but rejected the claims to the actual bacterium on the basis that living things are nonpatentable. Thereupon, Chakrabarty appealed to the Court of Customs and Patent Appeals. To the surprise of many, Chakrabarty won and the appeals court ruled that “The fact that microorganisms . . . are . . . alive . . . [is] without legal significance.” In this historic decision, the court rejected the distinction between living and nonliving matter as legally relevant. Now, the PTO was unsatisfied with this ruling and appealed to the U.S. Supreme Court. After some complex legal back-and-forth maneuvering, the Supreme Court upheld the appeals court’s ruling stating that “. . . Section 101 provides for the issuance of a patent to a person who discovers ‘any’ new and useful ‘manufacture or composition of matter.’” (Look at Section 101 of the Patent Law and reflect on how this tiny three-letter word “any” changed the course of science and technology). The court held:

A live, human-made, microorganism is patentable subject matter under §101. [Chakrabarty’s] microorganism constitutes a “manufacture” or “composition of matter” within that statute.

Thus, according to the majority opinion of the court, “the relevant distinction was not between living and nonliving things, but between products of nature, whether living or not, and human-made inventions.” Chakrabarty’s microorganism was not a product of nature but a product of human ingenuity—a patentable thing.

It is of some historical interest that, by the time the Supreme Court’s ruling was handed down in 1980, GE decided not to market the oil-eating bacterium. In contrast to GE, however, fledgling biotech companies (e.g., Genentech, Cetus) profited enormously from the ruling, which set the stage for the robust emergence of the biotechnology industry. The next decades saw the rapid growth of many biotech companies, and further research led to the patenting of a variety of microorganisms, plants, and ultimately higher order animals.

8.1.2. The Budapest Treaty

One of the problems of patenting new biological materials, such as microorganisms, is that they cannot be precisely described solely by a written disclosure. While chemical, mechanical, and electrical inventions can be described accurately by words, formulae, and drawings, new biological materials cannot, and it is usually the inventor who is the sole source of these things. In practice, it would be almost impossible to describe in writing, for example, the characteristics of a new strain of mutated bacterium or cell. But a fundamental requirement of patent law is enablement; that is, the details of an invention must be disclosed and documented so that others can reproduce and use it. If a microorganism is unavailable to the public, a written description cannot satisfy the law.

In the face of this conundrum, an international group of experts decided that for patenting purposes, a written disclosure must be supplemented by depositing a physical sample of the microorganism in an internationally recognized culture collection. This collection would maintain the sample and would supply it to the public during the lifetime of the patent. Without a deposited tangible sample, the patent application would not contain the needed full and complete disclosure and, consequently, would be rejected. Under the Budapest Treaty (officially called the “International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedure”) some 40 culture collections all over the world are recognized as “International Depositary Authorities,” which accept samples from applicants and make them available to anyone entitled to receive them.

8.1.3. The Consequences of the Supreme Court’s Ruling

The *Chakrabarty* decision opened the floodgates of granting patents claiming, as the Supreme Court put it, “anything under the sun made by man,” including

living things. This ruling spawned new industries, such as biotechnology and genetically modified foods, with major impact on society. There are now thousands of biotech and genetic engineering companies representing many billions of dollars of investment worldwide.

Since the *Chakrabarty* ruling, the PTO allows claims covering microorganisms but requires human intervention to make them useful. It also requires the showing that the patented organisms are different from naturally occurring materials. Similarly, a useful, novel, and unobvious compound produced by a known microorganism is patentable; and a useful, novel, and unobvious process made possible by a known microorganism may also be patentable.

The PTO has issued many hundreds of patents claiming various biological materials, such as bacteria, proteins, yeasts, viruses, genes, cell lines, seeds, and plants. And in 1988, it issued the first patent on a living higher animal, a mouse containing a specific gene, called an activated oncogene, which increases the mouse's susceptibility to cancer. This transgenic mouse was genetically engineered for use in cancer research. Such mice exhibit increased sensitivity to carcinogens and reduce the cost of experimentation on suspected carcinogens. They can be used to study the pharmacological effect of anticancer medicines and the results can be readily extended to humans. The research that created the mouse was carried out by researchers at Harvard University, but the licensing rights for the patent are held by DuPont, which financed the research. The claim of the patent (U.S. 4,736,866) is unusually broad reading on any species of "transgenic nonhuman mammal," which means DuPont has exclusive rights for any animal species whose genomes contain certain cancer-producing genes. This patent claiming the world's first patented animal is worth millions of dollars, and DuPont is marketing the mouse under the trade name OncoMouse. OncoMouse also recently became available from a commercial breeder (Taconic Farms) that ships it and other genetically engineered mice to researchers for the study of a variety of diseases (diabetes, obesity, heart disease, etc.).

In 2008, the FDA issued a guidance for the biotech industry. It declared that genetically engineered animals are considered new drugs and need FDA approval before they can be marketed. For example, Enviropig, an environmentally friendly pig, was approved for limited production and awaits full FDA approval for human consumption. Enviropig is a genetically altered pig that produces about 65 percent less phosphorous in its manure and urine than conventional pigs. Less phosphorous in animal waste is desirable because wastes run off into rivers, resulting in algal blooms, which in turn deplete the oxygen content of water and create dead zones for aquatic life. A transgenic fast-growing Atlantic salmon, called AquAdvantage, which contains a

growth hormone gene from a Chinook salmon and a gene promoter from the ocean pout, is also awaiting FDA approval. This salmon can be grown in sea cages like trout. An ornamental “day-glow” zebra fish that was genetically modified to fluoresce did not require FDA approval because this pet fish is not consumed by humans.

The patenting of genetic material created a huge market for private investors and companies. In 1994, the FDA allowed the first commercially grown genetically engineered food, a genetically modified tomato (FlavrSavr), to be sold for human consumption. A drug called ATryn, the first medicine produced using a genetically modified animal, was approved by the FDA for human use. ATryn is an anticoagulant produced in the milk of goats genetically engineered to produce human antithrombin, a protein with anticoagulant properties.

Although the breadth of cells, DNA, and living things that are patentable has grown steadily since 1980, the 2011 Leahy–Smith America Invents Act appears to run counter to this trend. This act contains a provision that specifically prohibits patent claims “directed to or encompassing a human organism.” While some do fear that the provision might prohibit the patenting of many useful discoveries, Congress has offered guidance in its official records showing that this fear is likely unfounded. The Congressional Record states that the provision is meant to prevent the patenting of embryos and fetuses, but allows for the patenting of genes, DNA, stem cell lines, and synthetic organs and tissue. U.S. courts have long struck down attempts to patent human beings, because they believe that this is tantamount to ownership of a person. With the passage of the America Invents Act, Congress extends the prohibition on patenting humans to include embryos and fetuses, because many members of Congress consider embryos and fetuses to be human life. The America Invents Act does not touch upon court rulings, like *Chakrabarty*, that allow inventors to patent nonhuman forms of life. Put simply, the America Invents Act allows the patenting of anything, except people, embryos, and fetuses. Figure 8.1 offers a lighthearted take on the America Invents Act provision that accurately conveys the central tenet of the act: Human life is not patentable, other forms of life still are.

Patent offices throughout the world are facing difficult fundamental problems. Scientific and technological progress engenders complex scientific and legal problems, as well as hosts of social, moral, and religious issues. Proponents of patenting living organisms and genetic engineering hold that patenting these things should be allowed because protection represents a justifiable reward for inventors’ ingenuity and hard labor. Opponents, on the other hand, believe that patenting living things is immoral and that genetic engineering is merely biological manipulation and not inventing. A further discussion of these matters is beyond the scope of this book.

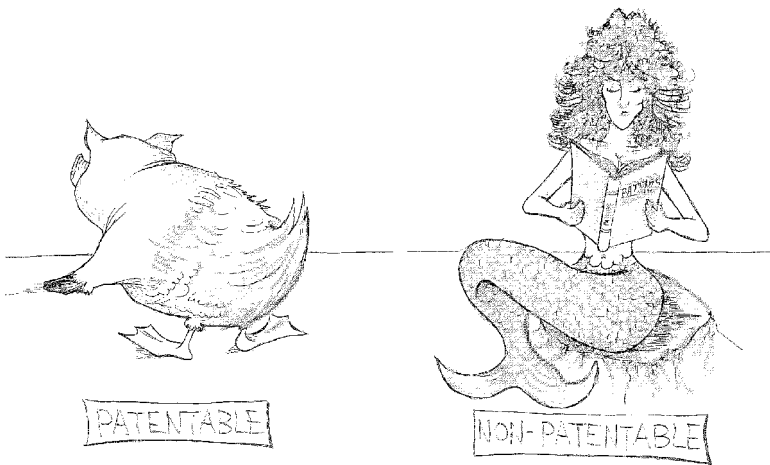


FIGURE 8.1. Patentable (nonhuman) and nonpatentable (human) organisms.

8.2. COMPUTER SOFTWARE PATENTS

The patenting of computer software is a complex and highly specialized field. This complexity is mainly due to the fact that computer software is the only field of technology where writing (i.e., a written program or mathematical equation) interacts with machines to perform a useful task. Thus, written texts or equations, which by themselves are not patentable by statute (see Section 5.2), become algorithms and part of the machine. A software program is not patentable if it merely solves a mathematical problem or equation, or if it only crunches numbers. However, the application of an algorithm to achieve something useful can become the subject of a patent. In other words, software that makes use of a mathematical expression to achieve a specific useful result is patentable. For example, a process in which a molding press is charged with unvulcanized rubber, and the curing time to convert the uncured rubber into an automobile tire is automatically calculated by software integrated with the press, is patentable. In such a case, the invention is a process for curing rubber and not the solving of a mathematical equation. In general, systems in which mathematical expressions control physical elements that, in turn, control machines and cause them to perform useful tasks may be patentable inventions.

In addition to patenting, computer software and computer procedures (algorithms) are also protectable by copyright because such “routines” consist of written material. Patent and copyright protection often overlap in the area of computer software. This overlap is because a computer program may be viewed either as a set of copyrightable written instructions (i.e., the words of a program may be viewed works of creative expression) or as instructions that

are part of a machine doing something useful, which is patentable. Indeed, the PTO has granted hundreds of patents for computer software attached to machines that perform useful tasks. Software falls under the “literary works” category of copyright law.

8.3. BUSINESS METHOD PATENTS

In the past few years, the PTO started to issue patents covering computer-implemented business methods and Internet operations. Traditionally, the PTO did not grant patents on business methods because they were regarded as abstract ideas, which are nonpatentable. However, in 1998 the Court of Appeals for the Federal Circuit (CAFC), the main patent court just below the Supreme Court, ruled that the intention of patent laws was to protect *any* method that yields a “useful, concrete, and tangible” result. [The spirit of this decision is perfectly in line with the Supreme Court’s decision in the epochal *Chakrabarty* case (see Section 8.1.1). In *Chakrabarty*, the use of the tiny word *any* from Section 101 of the Patent Law led to the patenting of a live microorganism and spawned the biotechnology industry.] In response to the ruling of the CAFC, the PTO started issuing patents to large corporations (e.g., IBM, GE, Hewlett-Packard) on computer-implemented business methods. This ruling also spawned significant new companies (e.g., eBay, Amazon) whose existence largely depends on patentable business practices.

Business method patents usually consist of a method or apparatus for “performing data processing” used in connection with or operating an aspect of an economic enterprise. A business method may also be defined as “a method of operating any aspect of an economic enterprise.” In the United States, business method patents have been issued primarily for new types of e-commerce, banking, tax tracking, management, and insurance. One of the most famous examples of business method patents is Amazon’s patented “Buy with One Click” system that allows the website’s repeat customers to make a purchase without entering billing or credit card information. Like other classes of patents, business method patents must pass the tests of patentability: patentable subject matter, utility, novelty, and unobviousness. Computer software and business method patents must also contain detailed specifications that enable people of ordinary skill in the profession to reproduce the invention without undue experimentation.

There have been challenges to the appropriateness of patenting business methods. In the 2011 America Invents Act, options are provided to those who seek to challenge the validity of a business method patent after the patent has issued, thus weakening the value of a business method patent. Nevertheless, business method patents can create significant value.

CHAPTER 9

WHO IS THE INVENTOR?

While working toward their degrees, many young researchers slave away on experiments just to see their names mentioned in the acknowledgments (or not at all) by their professor, who publishes a journal article on their work. In the world of publications, it seems not to matter much who originated the idea for the experiment or who sharpened that idea into a fundamentally new hypothesis. In U.S. Patent Law, however, this situation is reversed; it matters greatly who the inventor is—that is, who conceived the original idea for the invention. A patent application *must* contain the inventor’s name, and a patent can be invalidated if all inventors are not identified.

As with other parts of Patent Law, the basis for issuing patents to inventors comes from the Constitution, which mandates that the exclusive rights granted by Copyright and Patent Law are given to “authors and inventors.” Furthermore, Section 101 of the Patent Law 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

Thus, Patent Law is predicated on the idea that inventors are the only ones allowed to patent their inventions. The patent belongs to the inventor, although

an inventor can transfer the patent to another person by contract either before or after the patent issues.

So, who is an inventor according to the definition set out by Patent Law? The inventor is the one who *conceived the idea* for the invention or a component of the invention. An inventor need not have come up with every part of the invention; he just needs to have contributed to at least one claim that is essential to the invention's function or performance. Throughout the patent process, the number of people who qualify as inventors may change because claims will be added to or deleted from the patent application.

9.1. CONCEIVING AN INVENTIVE IDEA

It is important to clarify the definition of conception, because an inventor must have conceived the idea for at least some part of the invention. U.S. courts have consistently held that reducing an invention to practice is not enough, and an inventor must have meaningfully (patentably) contributed to the idea upon which the invention is based. In a 1930 case, the Court of Customs and Patent Appeals referred to conception as “the complete performance of the mental part of the inventive act” and the formation of a “definite and permanent idea” of the complete invention. This means that the inventor must have a strong sense of what the invention is and how it will work. When determining if one is an inventor, we must look at whether the idea was sufficiently specific that one skilled in the art could reproduce it.

A few examples may help to clarify who qualifies as an inventor. Say that the vice president of a food company recognizes that the company needs a newly designed tea bag. He discusses this with the research director, who suggests an electrospun nanofiber tea bag. The research director, in turn, discusses this work with the research engineer, who identifies the specific nanofiber for electrospinning, comes up with a specific glue to assemble the tea bag, and develops the general engineering line plus specifications. The research engineer gives the project to a sub-engineer to implement the process. In this example, the only inventor is the research engineer!

As another example, a research professor suggests a new line of research to an incoming student to make a new oxidatively resistant polyurethane. The student identifies why the old polyurethane was deficient and develops a specific solution to develop a better product by using a new ingredient. The student is the sole inventor! In contrast, the professor would likely be the senior author of a scientific publication on the same research. However, if a professor outlines the synthesis of a new structure (molecule, polymer, etc.) that he predicts will have unexpected useful properties for some application, and his student after many months or years of hard work makes, characterizes,

and proves it to be indeed useful as predicted, the professor is the sole inventor. (In the Preface, JPK recalls a similar sequence of events that occurred in an industrial setting and terribly upset him.)

On the other hand, if the professor suggests the synthesis of a fundamentally new and unobvious structure but has no idea what it could be used for, and his student finds utility for it, the student becomes a co-inventor.

9.2. JOINT INVENTORS

Many inventions are conceived by a team of inventors, rather than a single inventor. These “joint inventors” should all be named on the patent application, as long as they contributed at least one claim to the patent. This rule applies regardless of whether they worked in different locations, worked at different times, made different levels or types of contribution, or contributed research leading to different claims. For example, if two scientists originate a new chemical by working together, they are joint inventors. If a supervisor working in a totally different facility then comes up with a practical use for the chemical, he too is a joint inventor if both are included in a single patent. And if a team of technicians, working under contract for the company in a for-profit lab, develop an unobvious process for improving the performance of the chemical reaction, they are also joint inventors. This, of course, assumes that all of these claims are being used as a single invention. Many companies will split the claims into a series of separate patents. This splitting of an invention into multiple patents may make it easier to license because the patents will each likely be issued to fewer co-inventors.

The examples above contrast with some illustrations of individuals who would not qualify as joint inventors. The lab technician who uses a chemical in a conventional fashion to produce a new chemical is not a joint inventor. Nor is the research assistant who builds a device based on specifications given to him by a professor, or the helper who characterizes a novel polymer assigned to him by a supervisor. In each of these cases, the non-inventor is performing a task that those “skilled in the art” could be expected to accomplish. This may require a high level of know-how, but the work is not novel or unobvious, as required by Patent Law. The lab technician, research assistant, and helper did not conceive the idea for the invention.

One final example adds a layer of complexity to the rules on inventorship. A university professor comes up with the structure of a novel polymer and predicts its usefulness in the biomedical industry. Then, the professor’s research assistant synthesizes the polymer by an unobvious technique. In this case, both would be entitled to a patent: the professor for conceiving the composition of matter and the research assistant for the unobvious process.

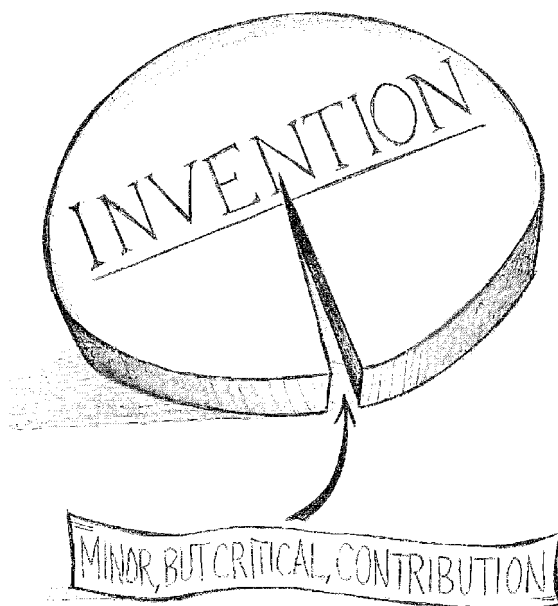


FIGURE 9.1. Even a small contribution qualifies one to be a co-inventor (or joint inventor) if it helps to complete the invention (claim).

These inventions might be able to be combined as separate claims in a single patent or could be patented separately.

In the corporate and academic worlds, some ideas are conceived during brainstorming and ideation sessions, often with several researchers and perhaps marketing experts present. These sessions tend to be more productive than single person invention. When multiple persons invent, there are often joint inventorship considerations. A person is a joint inventor even if his contribution is minor, if the idea contributed was necessary to complete the invention or to make it operable (see Figure 9.1.) Patent attorneys are frequently relied upon to determine who should be listed as an inventor in a patent application. It is safest to identify anyone who contributed to the conception of the idea and then let the attorney determine if such person's contribution is covered by a claim in the patent application.

There is no such thing as a best thought or greatest contribution to an invention; all inventive contributions are valued equally when deciding who qualifies as an inventor. To that end, there is no main or senior inventor listed on a patent. In contrast, in the world of scientific and technical publications, the first listed name is very important. We often say that Jones et al. gives the glory to Jones. By contrast, the sequence of names on a patent is of

no importance. Unless otherwise agreed by the inventors, all inventors have equal rights, regardless of the order of their names.

9.3. NAMING INVENTORS ON PATENT APPLICATIONS

Patent applications must identify all joint inventors by their full names, mailing addresses, and countries of citizenship. Each inventor named on the patent must complete an oath or declaration in which the inventor swears that he believes the named inventors are the original and first inventors of the invention. (See the facsimile of the Inventor's Oath in Appendix 1, Form G.) Special documents can be filed in lieu of the oath for joint inventors who have died, are under legal incapacity, or cannot be located after a diligent search.

While the PTO can invalidate a patent if an applicant intentionally omits an inventor, an applicant or patent holder is not penalized for erroneously including or excluding an inventor. The applicant can amend the application or the issued patent should this occur. If one of the joint inventors refuses to sign the application or cannot be found, the other inventors can file on his behalf, provided that they inform the PTO that an inventor has been omitted and attempt to give notice to the omitted inventor. The omitted inventor can later join the application, even if he initially refused to sign the application. Similarly, if an inventor has died or is incapacitated, his legal representatives can apply for a patent on his behalf. If an inventor sells his rights in a patent to others, the potential owners can apply for the patent even if the inventor refuses to execute a patent application or cannot be found.

9.4. QUALIFICATIONS TO BE AN INVENTOR

A final note to young researchers: There are few limits on who can obtain a patent in the United States. One need not be a U.S. citizen to obtain a U.S. patent, just as U.S. inventors can file for patents in Canada, Japan, or the European Union. The sole exception to the rule that anyone may obtain a patent is that employees of the U.S. Patent and Trademark Office may not obtain a patent during their term of employment and for one year after their employment ceases.

CHAPTER 10

OWNERSHIP

Ownership is a bundle of rights in a property. Real property such as land, personal property such as cars and furniture, and intellectual property such as patents and copyrights are all forms of property in which the various ownership rights apply. As an example, the “owner” of a parcel of land has the right to enter the land, live on the land, build a house on the land, legally exclude others from entering the land, sell the land, or just give the land away. These rights are bundled into a single concept we call “ownership.” With patented intellectual property, this bundling concept is also apparent, because the owner of a patent has a well-delineated bundle of rights in the patented invention established by the Patent Law. As noted in Section 1.1, a patent confers upon its owner the right to exclude others from making, using, offering for sale or selling the invention in the United States or from importing the invention into the United States. A patent does not give its owner the right to make, use, sell, or import the invention.

Now we need to determine who owns an invention. Fundamentally, the owner of the patent is the inventor, who conceived the idea or performed the creative or inventive step.

10.1. SELLING, LICENSING AND ASSIGNING PATENTS

A patent is like any other form of property in that its ownership can be sold, licensed, or given to another person. Co-owners have equal power in regard to patent rights, meaning that they have identical rights to exclude other non-owners from making, using, selling, or importing the invention. Furthermore, a co-owner can license the invention to a third party without the consent of the other owners. However, all co-owners must join together to grant an exclusive license, because allowing a single co-owner to exclusively license the invention would infringe upon the rights of the other owners.

Patents can, and often are, sold to individuals or entities that intend to commercialize them. Patents can also be assigned to a company or person, meaning that the inventor gives away his rights in the patent even before the patent is granted. Many companies include an *assignment clause* in their employment contracts, which automatically assigns all inventions an employee makes within the scope of her work to the company. Finally, a patent owner can license her patent to an individual or company, meaning that the owner can enter a contract that gives another person (the licensee) the right to make, use, sell, or import the patented invention. A license agreement need not give the licensee the right to do everything the patent holder can do. For example, a license agreement can give the licensee the right to use the invention, but not to make, sell or import it. A license can be granted for selected geographic areas or specific market sectors, with the licensor keeping the remaining rights or licensing the rights to other people or companies. Under a license agreement, the patent holder cannot sue the licensee for engaging in any *licensed* activity (see also Section 11.3).

10.2. HIRED-TO-INVENT AND SHOP RIGHTS

An exception to the general rule that an inventor owns his invention is the *hired-to-invent doctrine*. This doctrine states that, even in the absence of an assignment agreement, an employee is presumed to have assigned any inventions an employer specifically contracted for, to the employer. For example, an employee who is hired specifically to build a new digital fuel injector for Ferrari is presumed to have assigned this invention to Ferrari under the hired-to-invent doctrine, even if Ferrari forgets to put an assignment clause in his employment contract. The assignment means that Ferrari has all rights to the invention and the inventor has no right to make, use, sell, or import his invention. On the other hand, if an employee who works for Ferrari comes up with a brand new assembly line configuration, this patentable process may not be automatically assigned to Ferrari, because the invention may not

have been specifically contracted for and thus the hired-to-invent doctrine would not apply. The hired-to-invent doctrine has similarities to, and is sometimes confused with, the work-made-for-hire doctrine, which is applicable to copyright.

This example leads us to a second exception to the general rule that inventors have sole ownership of all rights to their inventions: the “*shop right*.” Under the shop right rule, an employee who uses his employer’s resources to create something he was not hired to invent owns his invention; however, his employer retains an *automatic nonexclusive license* to use the invention. This means that, in the above example, Ferrari can use the new assembly line configuration in its factory, but the inventor is the true owner of the invention. Only the inventor can sell or license the right to make, use, or sell the new assembly line to another person or company.

10.3. INVENTING ON YOUR OWN TIME

Independent inventors can exclusively own the rights to their patents even if they are employed by a company. Those seeking to be independent inventors should check their employment agreement and employee handbook to read the language of any assignment agreement that applies. Some assignment agreements may require the assignment of everything created during the period of employment (even for several months after an employee quits). However, most assignment agreements are more narrowly written and some states will not allow courts to enforce assignment agreements that include inventions in a field of expertise different from that for which the employee was hired. In the absence of an enforceable assignment agreement, an employee can generally claim exclusive rights in an invention that she develops on her own time provided she did not use her employer’s labs or equipment. It also helps if the employee’s invention is in a different field than the field she was hired to work in. For example, a chemist who was hired to formulate new cleaning products will likely own a light bulb that she conceived and reduced to practice in her garage on the weekends. However, if the same chemist invented a new window cleaner, it will likely belong to her employer regardless of whether she reduced the invention to practice in her garage and on the weekend.

10.4. NON-COMPETE AGREEMENTS

A *non-compete agreement* prevents a current or former employee from going to work for a competing company. Such agreements can be self-contained

contracts or a clause in a larger employment contract. By signing a non-compete agreement, an employee contractually promises, in exchange for compensation, not to work for companies in a related industry or similar profession while they are employed and for a specific period of time after the employee ceases working for the current company. If the terms of the non-compete are violated, the company can sue its former employee to (a) enjoin (i.e., prevent) him from disclosing or using the information in his new job and (b) force the employee to pay monetary damages. California, by way of exception, has enacted laws that limit an employer's ability to enforce non-competes because California believes that enforcing a non-compete places an unfair burden on employees, who should have complete freedom to find a new job. Most other states honor the ability of parties to make their own agreements by allowing for enforcement of non-competes so long as the court finds the agreements are reasonable in extent of employment prohibited, breadth of geographic area, and length of time. For example, a court is likely to enforce a non-compete agreement that prohibits a former employee from working as a researcher creating cleaning solutions for one year within 25 miles of the research facility at which he previously worked. This would be considered a reasonable way to honor the investment the company made in training the employee by giving the company some limited protection against the employee competing directly against the company. Conversely, a court is likely to hold invalid or substantially rewrite a non-compete agreement that prevents a former employee from working in the chemical industry for 10 years anywhere in the United States. Such an agreement would greatly exceed the company's investment and severely limit the employee's ability to find a new job.

An addendum to the non-compete agreement may be a *trailer clause*, which assigns all inventions developed by an employee within, for example, six months of the end of employment to her former employer. The theory is that an employee may have conceived the idea for the invention while working in the company and then quit to reduce the invention to practice and reap the economic gains on her own. Inventors are well advised to closely read their employment contract and consult an attorney when switching jobs.

10.5. THE BAYH–DOLE ACT

During their early existence, universities served mainly as disseminators of knowledge, teaching students with less focus on developing new knowledge on their own. In the nineteenth century, universities began creating knowledge through research, which was funded largely by federal grants. The passage of the Bayh–Dole Act in 1980 signaled a paradigm shift in the role of

universities vis-à-vis society. Armed with the rights given to research institutions by Bayh–Dole, universities began commercializing knowledge by patenting inventions created in their labs and actively marketing them to industry partners. Today’s universities are expected to be entrepreneurial, to conduct research with real-world applications, and to network to industry partners that can help them bring technology to market.

Congress passed the Bayh–Dole Act of 1980 to (a) promote the dissemination and commercial development of inventions arising from government-sponsored research at universities and (b) foster greater collaboration between universities and industry. Prior to passage of the Bayh–Dole Act, the U.S. government owned inventions made with federal research funding, which also meant that the federal government was responsible for patenting and licensing these inventions. By the 1970s, the government had accumulated some 30,000 patents, of which only about 5 percent had been licensed. Negotiating a license with the federal government was an onerous undertaking because the federal government had complicated rules for licensing.

Bayh–Dole was predicated on the theory that universities were better suited than the federal government to commercialize technologies invented and developed in university labs. The Bayh–Dole Act’s goal was to give inventors and their employers a stake in the commercialization of these inventions by having the right to elect ownership in preference to the government, and thus an economic incentive. In most cases under Bayh–Dole, the contractor research institution, such as a university or small business, holds title to the invention by virtue of applicable employment policies or agreements. Importantly, Bayh–Dole requires that university inventors be given a share of any licensing revenue that their inventions bring to the research institution. The research institution is required to grant to the federal government a nonexclusive, nontransferable, irrevocable, paid-up license to the patents funded for governmental use. Universities are significant beneficiaries of Bayh–Dole as are faculty researchers, industry, government, and the public at large.

10.5.1. March-In Rights

Along with the right to patent and license university inventions, universities have the responsibility to actively market their inventions. The federal government maintains a *march-in right*, which allows it to take ownership of patents for federally-funded inventions if a university does not adequately market a technology or refuses to license a patent under reasonable terms. While the march-in right is seldom used, its existence illustrates how serious the federal government is about imposing a duty to actively market technology.

10.5.2. University Technology Transfer

As a result of Bayh–Dole, a new industry and profession emerged commonly referred to as *university technology transfer*. University technology transfer professionals have largely been tasked with facilitating the translation of research into useful products and services. University technology transfer offices are found at all institutions with significant research portfolios. These professionals identify research and technology with commercial potential, seek patent and other intellectual property protection, develop commercialization strategies, identify potential licensees, license the intellectual property, and monitor license compliance. In 2010, the Association of University Technology Managers, a trade association for technology transfer professionals, reported that U.S. universities introduced 657 new commercial products, executed 4284 licenses, and formed 651 new companies with 3657 startup companies still in operation from prior university new enterprise creation efforts. Most years, U.S. universities collectively earn more than \$1 billion in licensing revenue as a result of their rights under Bayh–Dole.

In a December 2002 article, *The Economist* (one of the most influential weekly magazines in the world) described the Bayh–Dole Act as “possibly the most inspired piece of legislation to be enacted in America over the past half century . . . *more than anything, this single policy measure helped reverse America’s precipitous slide into industrial irrelevance.*” Examples of technologies emanating from university research and commercialized as a result of Bayh–Dole include synthetic penicillin, instruments for laser surgery, the hepatitis B vaccine, Gatorade[®], Citracal[®] calcium supplement, cisplatin and carboplatin (cancer therapeutics), synthetic Taxol, human growth hormones, Alegra[®] anti-histamine drug, treatments for Crohn’s disease, and the Avian Flu vaccine.

University technology commercialization has become a major component of regional economic development strategies. Economic development professionals place significant value in building regional innovation support programs with the expectation that new technologies that are created and commercialized will be a source of job growth and wealth creation. Technology-based economies are almost always aligned with major research universities. Examples include biotechnology in San Diego with University of San Diego and the Scripps Institute, among others; information technology in Silicon Valley with Stanford University and The University of California at Berkeley among others; and medical devices in Boston, Cleveland, and Minneapolis with Harvard University, Massachusetts Institute of Technology, Boston University, Case Western Reserve University and the University of Minnesota, among others; and polymers and advanced materials in Akron, Ohio with The University of Akron.

CHAPTER 11

TRANSLATING IDEAS INTO ECONOMIC REWARD

A patent can be a valuable economic asset for bringing new technology to market. Conversely, it can also be a phenomenal waste of money if the patented invention has little commercial potential. The first sections below discuss key points to consider before patenting an invention: determining the cost of patenting, assessing whether an invention has commercial potential, and protecting an invention even before a patent issues. Subsequently, we discuss technology marketing strategies, as well as turning knowledge into wealth (i.e., turning a patent into money) by selling, licensing, or creating a new company. We also introduce you to the principles of patent valuation, which is estimating the value of a patent.

11.1. THE COSTS OF PATENTING

The cost of drafting, filing, and prosecuting a patent typically ranges from \$5000 to \$15,000, depending upon the complexity of the patent application, according to *IP Watchdog*, an online news magazine about intellectual property. The major costs of filing a patent application include the cost of having a patent attorney or agent to draft the claims, and the application fee.

How to Invent and Protect Your Invention: A Guide to Patents for Scientists and Engineers, First Edition. Joseph P. Kennedy and Wayne H. Watkins with Elyse N. Ball.
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Thereafter, there are additional and usually significant costs for the attorney to shepherd the application through prosecution with the U.S. Patent Office, which include responding to the almost always initial denial of the patent application. There are also maintenance fees to keep a patent active after it issues (if awarded).

11.1.1. Legal Fees

As discussed in Section 5.6, which outlined the elements of a patent, many inventors are capable of writing the specification; however, few inventors have the legal skill necessary to draft claims. Nor do many inventors wish to go it alone when filing the application and tracking its progress through the PTO. With legal fees of several hundred dollars per hour, the cost of an attorney's help can quickly add up.

11.1.2. Patent Application Fees

Another major cost to inventors seeking a patent is application fees. Among its many changes to the patent system, the Leahy–Smith America Invents Act, passed in September 2011, set out a new fee schedule for patent applicants to help small businesses and independent inventors. Under this act, all filing, prioritized filing, maintenance, and searching fees are reduced by 50 percent for small businesses, independent inventors, or nonprofit organizations. (The definition of small business under the act is taken from another area of federal law and varies from industry to industry.) Furthermore, these fees are reduced by 75 percent for “micro entities,” which are accredited universities and colleges, as well as independent inventors who have not filed more than four U.S. patent applications, did not earn more than three times the national average income the previous year, and are not under an obligation to assign their patent to another person or company. Table 11.1 shows the filing fees for standard applications (first digits in the table), for small businesses, independent inventors, and nonprofits (second digits), and for micro entities (third digits) as of 2012. A link to the current PTO filing fee schedule can be found at <http://www.uspto.gov/about/offices/cfo/finance/fees.jsp>.

In addition to the fees listed above, inventors may have to pay additional fees for accelerated examination, if the application exceeds 100 pages, if there are more than three independent claims, or if there are more than 20 total claims. If the patent or one of its claims is denied and the inventor wants to appeal, the applicant must be represented by a patent attorney. The administrative costs of appealing the denial alone (not including the legal fees) generally exceeds \$2000.

TABLE 11.1. Filing Fees as of 2012

Fee	Utility Patent	Design Patent	Plant Patent	Provisional Application	Reissue of Previously Abandoned Patent
Application	\$330/\$165/ \$82	\$220/\$110/ \$55	\$220/\$110/ \$55	\$220/\$110/ \$55	\$330/\$165/ \$82
Examination	\$220/\$110/ \$55	\$140/\$70/ \$35	\$170/\$85/ \$42	—	\$650/\$325/ \$162
Issuance	\$1,510/\$755/ \$378	\$860/\$430/ \$215	\$1,190/\$595/ \$298	—	\$1,510/\$755/ \$378
Searching	\$540/\$270/ \$135	\$100/\$50/ \$25	\$330/\$165/ \$82	—	\$540/\$270/ \$135

Standard applicant/small businesses/micro entities.

11.1.3. Patent Maintenance Fees

Once an inventor has patented his invention, he may terminate patent protection before the patent's automatic expiration in 20 years. Holders of utility patents must pay maintenance fees, which escalate in cost, at three points during the life of their patent (see Section 6.7). If these fees are not paid, the patent automatically expires. The decision to forgo paying a fee and allow the patent to expire is called *abandonment*. Patent owners, who are frequently employers or independent inventors, pay the costs of a patent. Thus they are continually assessing the potential benefit of the patent versus the cost of patenting. When in their estimation the cost exceeds the potential benefit, they make the decision to abandon the patent. That is, they elect not to pay for patent maintenance, and thus the patent lapses and is deemed abandoned. Many inventors seem not to like the idea of abandonment and may continue paying fees on an invention, notwithstanding its unlikely commercial viability. However, maintenance fees total thousands of dollars over the life of a patent and they increase with time. Thus, prudent inventors reappraise their invention before each maintenance fee comes due using the technology validation and commercial viability assessment techniques discussed below.

11.2. ASSESSMENT

While essentially all inventions are valuable for the progress of science, engineering, and technology, not all inventions can be translated into commercially viable products or services. Because patenting is expensive and time-intensive, an invention that cannot be turned into a saleable product or

service should not be patented. Inventors should consider the following major factors before moving forward with a patent application: (1) technology validation, (2) ability to protect the technology by patent or some other form of intellectual property, and (3) commercial viability or marketing considerations. These factors, discussed below, can be explored simultaneously. The absence of even one of them should make inventors leery of the wisdom of patenting.

11.2.1. Technology Validation

Technology validation requires an inventor to explore the soundness of prior experiments and to replicate past experimental results. Validation can be performed by the inventor himself or by external groups under *Non-Disclosure Agreements* (discussed below) if the invention has not yet been patented. In addition to merely replicating prior experiments or testing an invention in a laboratory, technology validation should include additional experimentation under a wide variety of conditions and developing a best mode for disclosure in a future patent application. It could also include optimizing the manufacturing procedure—that is, seeing if the product of the invention can be created in fewer steps or using cheaper materials. Optimization could be crucial to determining commercial viability because a cheaper version of the invention will be much more likely to be purchased by consumers. Frequently, technical validations are performed by independent parties, including experts in the technology and potential licensees, who assess the technology and verify that it is what the inventor claims it to be.

11.2.2. Protection Validation

Successful licensing and business creation requires a competitive advantage, and this advantage cannot be maintained without some way to protect one's invention, at least in the short-term. An unprotected invention can be easily stolen by a competitor or even a potential licensee. Two major methods allow inventors to protect their inventions as they attempt to commercialize them: patent protection (which is the focus of this book) and trade secret protection. Before spending too much time on experimentation or developing business partners, the inventor should determine whether sufficient protection exists to allow the invention to be commercialized. The inventor should also determine which method of protection is more appropriate for his invention.

11.2.2.1. Assessing Patent Protection. An inventor who seeks to use patent protection for an invention needs to do more than simply understand the advantages and disadvantages of such protection. The inventor must

also explore whether the invention is eligible for protection under Patent Law's statutory requirements. An inventor should also at this point consider protection through the means of trade secret. Most inventions that an inventor seeks to commercialize are ultimately protected by patent. Although they are limited in duration, patents generally offer much stronger protection to an independent inventor than do trade secrets. Unlike trade secrets, there are limits on the kinds of inventions that can be afforded patent protection. An inventor must consider this when assessing the potential for protection. Only useful, novel, unobvious inventions that fall into specific categories can receive patent protection. Section 5.2 outlines the types of inventions eligible for patent protection, including processes, machines, and compositions of matters. Furthermore, patent protection may not be obtained if prior art renders the invention either not novel or obvious (see also Section 5.4.3).

To determine whether patent protection is possible, inventors must examine previous patents and publications of all types from anywhere in the world. An inventor can begin her quest by searching online patent databases (e.g., Google Patents) and online collections of journals. Inventors would also be well advised to consult a patent attorney or agent, who can have his staff conduct a complete patent search and advise whether similar patents and publications found are likely to prevent the inventor from obtaining a patent on her invention.

11.2.2.2. Assessing Trade Secret Protection. An alternative to patent protection is trade secret protection (first discussed in Section 4.2). Trade secrets must have two elements: (1) They must be kept secret and (2) they must be valuable, meaning they give the person or company that holds them a competitive advantage. Trade secret protection can protect a much wider range of valuable information than patent law. While patent law only covers useful, novel, and unobvious inventions that fall within specific areas of subject matter, trade secrets have no such limitations (they need only be secret and valuable). Trade secret protection can cover know-how, expertise, formulas, designs, patterns, modes of doing business, customer lists, and unpatentable processes. In fact, trade secret protection can cover virtually anything that can be effectively kept secret.

The major disadvantage of trade secret protection centers on the first element of trade secret protection: A trade secret must be kept secret. Trade secret protection is not particularly useful for information that must be shared with a large number of people within an organization. For example, hundreds of foremen must know the make-up of a particular type of steel in order to manufacture it. If even one of those foremen lets the trade secret slip, it is no longer effectively protected. Similarly, trade secret protection is not useful for items that can be easily reverse-engineered. Mechanical devices, like cars or

simple machines, are not amenable to trade secret protection because anyone who buys the item could reverse-engineer it. Finally, trade secrets do not protect their owners from the possibility that someone might independently develop the trade secret at a later time. For example, an energy company develops a novel method for enriching uranium. The energy company will protect this information as a trade secret because inventions related to nuclear energy are not eligible for patent protection (by law) and this process gives them a competitive advantage. Five years later, a university researcher stumbles upon the exact same method for enriching uranium during part of his research. The university researcher publishes papers on this method because he wishes to attain tenure and because he feels his discovery ought to be shared with the public. The energy company has no redress against the university researcher, even though it developed the method first.

On the other hand, trade secret protection may be very useful for certain chemical formulas that cannot be easily reverse engineered, manufacturing processes that involve a small number of people, and industry know-how that is not eligible for patent protection. Some specific examples help to illustrate this point. The most famous example of trade secret protection is likely the “secret recipe” for Coca-Cola, which has been protected as a trade secret since 1925. Allegedly, only a few top Coca-Cola executives know the recipe at a given time, and those that manufacture Coca-Cola do not need to know the full recipe to do their jobs. While several people have proposed possible recipes for Coca-Cola, no one has been able to definitively reverse-engineer its recipe. Another common trade secret is manufacturing processes, such as processes used for making certain chemical compounds. Once again, these processes are more easily protected if most people do not need to understand the full process to effectively do their jobs. Similarly, chemicals that are created as intermediate steps in a manufacturing process can be effectively protected as trade secrets, because they would be difficult to reverse-engineer. Finally, many types of industry know-how are protected as trade secrets because they are not eligible for patent protection. Examples include business customer lists, protocols for conducting research, pricing guidelines, advertising strategies, and methods for distributing goods.

11.2.2.3. The Economic Espionage Act. The United States adopted the Economic Espionage Act of 1996 to make theft or misappropriation of trade secret a federal crime. It covers commercial trade secret information, that is not classified or national defense information, and was adopted in recognition of the significant theft of industrial trade secrets that occurs. As the consequences are criminal and can ruin careers, aspiring innovators must learn the boundaries of what is acceptable knowledge or intelligence gathering

TABLE 11.2. Differences Between Patent and Trade Secret Protection

Patents	Trade Secrets
Absolute monopoly for 20 years	Potentially limitless monopoly
Continued protection is guaranteed	Protection is easily lost
Right to sue others who make, use, or sell same technology	No protection if someone else develops same technology
Easy to sell or license by contract	Sale or license could undermine strength of secret
High initial filing costs	No initial filing costs (free)
Periodic patent maintenance fees	Costs of keeping invention secret can become quite high
Easier to attract money from investors	More difficult to attract money from investors
Disclosure can benefit society and spur future inventions	Secret provides no benefit to society

and sharing, as well as what crosses societal norms of propriety and becomes criminal theft.

Trade secrets are also protected by court-made doctrine (what lawyers refer to as “case law”), which was established over the years as courts issued rulings on cases involving trade secrets. Under these rules, courts only intervene to stop someone from using a trade secret if they used illegal or outrageous methods to misappropriate the trade secret from the person or company that originated it. Breaking into a company’s headquarters to steal a trade secret would be illegal. Similarly, paying off a company’s employees to gain a trade secret could be illegal and would likely be considered outrageous by a court. A particularly entertaining example of outrageous conduct occurred when two brothers hired a pilot to fly low over a DuPont chemical factory that was being constructed. The pilot’s goal was to take pictures that would help the brothers learn more about DuPont’s trade secret manufacturing process. The court that heard the case noted that DuPont could have erected a giant tent to cover its construction site, but the brother’s conduct was far too outrageous to be allowed. If conduct is found illegal or outrageous, a court can legally prevent the trade secret thief from using or disclosing the secret.

Table 11.2 provides a summary of our discussion of the differences between patents and trade secrets, and is helpful for determining which is more appropriate to protect your technology.

11.2.2.4. Non-Disclosure Agreements (NDAs). Companies may wish to share a trade secret with another company as a way to generate licensing revenue. Similarly, an inventor may want to share his invention with others that will help him assess the soundness of his technology, optimize his

manufacturing process, or find potential licensees for his invention. In either of these cases, the company or inventor should have the other party sign a *Non-Disclosure Agreement* [NDA, also sometimes called a confidentiality agreement or confidential disclosure agreement (CDA)].

An NDA is a contract that requires the recipient of trade secret information or information regarding an unpatented invention to make a legally enforceable promise that she will not share the invention with others or use the invention herself without permission. An individual who violates the NDA can be liable for monetary damages and can also be legally prevented by a court from continuing to use or patent the invention. NDAs are not necessary when discussing an invention with an employer (who will ultimately benefit from patenting the invention under an assignment agreement) or an attorney (who is prevented from revealing the details of your discussion by attorney–client privilege). Qualified legal counsel is the best source for appropriate preparation of an NDA. Notwithstanding, a sample NDA is shown in Form E in Appendix 1 or may be found online.

11.2.3. Commercial Viability and Market Assessment

The objective of commercial viability assessment is to determine whether an invention can be turned into a profitable product or service. This may be difficult for inventors versed in scientific research but lacking training in product development, manufacture, distribution, finance, management, marketing, and general economics. One way to get a quick assessment of the potential market for the invention is to determine its most likely uses. The inventor can then run a Google search for other products that perform the same or a similar function and see the price of these products. For truly novel inventions, this step will require creativity because the inventor must try to predict what existing products would compete against her invention. A more exacting method for determining commercial viability is for inventors to ask companies, potential licensees, or buyers about their product and its commercial value. Inventors can also hire professionals to conduct commercial viability studies and to brainstorm potential uses for the invention.

The foundation of successful commercialization is the creation of products and services that are valued in the marketplace. Yet a valued product or service alone is insufficient for commercial viability. A product must be designed, qualified, manufactured, marketed, distributed, and supported with maintenance and repairs. Thus, the threshold questions leading to commercialization include:

- Do I have a product or service that can be produced or provided and that fulfills a function or role?

- Will someone pay money for this good or service?
- Can I produce the product or service cost effectively?
- Can I meet all regulatory or other limitations that are applicable?
- Will the revenues likely exceed the anticipated costs to create, produce, and distribute?

If the answers are yes or likely yes, then the commercialization partner proceeds to develop and implement a commercialization strategy. Questions that should be asked and addressed in the commercialization strategy include:

- Who (types of people and organizations) would pay?
- How much would they pay?
- What systems or components of systems would they prefer to buy?
- What quantities of products or services are they likely to purchase?
- Can the product or service be provided for a reasonable cost?

Commercial viability assessments can be as crude as a few notes and graphs on a napkin or as elaborate as lengthy feasibility and business plans produced by sophisticated teams either internal to an organization or hired external to the organization. Regardless, in all cases they address the basic questions. Once assessed, then the implementation of a plan begins.

11.3. SELLING AND LICENSING A PATENT

Selling and licensing differ in the method in which the patent holder's rights are transferred. Selling a patent transfers all rights associated with the patent, including the right to make, use, sell, and import the patented invention. Selling usually has the advantage of allowing the inventor to realize commercial gain immediately, if the sale includes an upfront payment. Thus, one receives compensation prior to bearing the risks that the invention will not become economically successful. However, if the inventor sells the patent, he no longer has control over the invention and likely will not make any additional money if the invention becomes a commercial success beyond what was expected when the terms were negotiated, unless the sale agreement included a provision for subsequent payments based on commercial success.

11.3.1. Licensors and Licensees

Licensing takes place when a patent owner gives someone the right to make, use, sell, or import the invention, in exchange for some type of payment. In a

license agreement, ownership remains with the *licensor*, who grants another the right to make, use, sell, or import her invention, while the *licensee* is the person or company that gains the right to use the invention. Unlike the single payment that is often made when a patent is sold, licensees usually pay the inventor/licensor either a periodic flat payment or, more commonly, a percentage of revenue earned from the use of the invention. For example, a licensee might pay the inventor \$1000 for each month he is allowed to use the invention, or five percent of the money received from the inventions sold.

11.3.2. Exclusive versus Nonexclusive Licenses

Licenses can be either *exclusive* or *nonexclusive*. An inventor grants an exclusive license when he promises, in the licensing agreement, that the patent will not be licensed to others. A nonexclusive license occurs when the inventor retains the right to license the patent to others. Licenses can be limited in time, geographic scope, or types of uses. For example, a licensor can specify that it gives the licensee only the right to use the invention (not make, sell or import it) for five years in the automotive industry in Michigan.

Licensing has the advantage of giving the patent owner some contractual control over how his invention is used. An inventor/licensor may be able to continue research and commercialization of the invention and stands to earn more money if the invention is a success. An inventor can grant many companies licenses to use the invention in different manners, industries, or countries. For example, an inventor could grant the right to use an implantable biomaterial for human or animal use, for uses in the chest or eye, or for catheters in the stomach, depending upon how broad the inventor wanted the license to be. Inventors can even allow multiple licensees to use the exact same invention in the exact same way, as long as the license agreements are nonexclusive, meaning that no one licensee has the exclusive right to the patents. In this way, the inventor can increase the likelihood that his invention will be successful by giving multiple licensees a stake in its success.

The likelihood of commercial success is significantly improved if the license is exclusive. This is always the case if the invention requires significant investment before it can be commercialized. A party will not have financial incentive to make the investment if another party can reap the rewards of the investment to the investor's detriment. An example is a new pharmaceutical drug, which often costs hundreds of millions of dollars to develop, to take through clinical trials, to obtain other governmental regulatory approvals, and to manufacture and market. No drug company will invest in a drug if knock-off drugs will be placed on the market by those who did not bear the costs of development and commercialization, as soon as the drug is developed and approvals are obtained. Typically, licensees negotiate strongly for broad,

exclusive licenses. Thus, an inventor may need to choose between an exclusive license or no license agreement at all.

11.4. START-UPS, SPIN-OUTS, AND JOINT VENTURES

Start-ups are new companies created by entrepreneurs. While the term start-up includes any new business, like bakeries or lawn care providers, we will use the term start-up to refer to a recently created company established expressly to commercialize a new invention. Inventors that do not wish to sell or license their patents may instead choose to establish a start-up. While an inventor could do the same work as a sole proprietor without creating a new company, organization of the project into a corporation or limited liability company can protect the inventor from some forms of liability, make it easier to obtain investment money, and look more official to potential partners, employees, and investors. The inventor creates a legal entity, like a corporation, by filing documents with a chosen state's office of corporations or business associations. He then licenses patents, trademarks, copyrights, or trade secrets related to the invention to the start-up. In addition, the inventor may invest his time, money, and know-how into making the company successful.

Start-ups are a good option for inventors who wish to control the commercialization of their invention and who have the requisite passion, expertise, and capital. However, they also require significant time and resources including a lot of non-research work, like bookkeeping, marketing the invention to investors and business partners, and developing a business plan. While inventors can involve business partners or employees to complete these tasks, inventors who want to focus on research or quickly move to new projects are probably not well suited to running a start-up.

Spin-outs and *joint ventures* are two commercialization phrases that industry inventors should be familiar with. Spin-outs are start-up companies that "spin-out" of a university or corporation's research and development efforts. A spin-out company is a start-up that emerges from a larger corporation or a university, rather than by an independent entrepreneur. Some people also call spin-out companies spin-offs (perhaps a reference to the more familiar situation where a new TV show is created to feature a character from a pre-existing show; for example, *The Colbert Report* is a spin-off featuring former *Daily Show* correspondent Stephen Colbert). While the originating university or corporation may retain some ownership stake in the spin-out, the spin-out takes on a life of its own, functioning autonomously, and it may outlive the company that spawned it. Often, the inventors who originated the intellectual property will become part of the technical team of the spin-out.

Joint ventures occur when two or more companies with complementary resources or expertise combine their assets in a mutually beneficial project. To that end, the companies form a new business entity (often a corporation or limited liability company) or collaborate by contract. Once a new company has been formed, each joint venture partner commits resources to the company, which may include money, patents, or other intellectual property, office or lab space, or employees. Thus, researchers who began their careers working for one company may find themselves working in a totally different environment with fewer resources and supports, but with more opportunities for creative autonomy and a chance to move quickly in commercializing an invention.

11.5. PATENTING AND MARKETING DEPARTMENTS; TECHNOLOGY TRANSFER OFFICES

While independent inventors make patenting and marketing decisions themselves, most companies and universities have departments that make these decisions on behalf of the institution. In industry, intellectual property-related decisions are often fragmented over several departments, including the company's research leadership, legal department, business development department, and marketing and communications teams. At most universities, intellectual property decisions fall to a technology transfer office, a department dedicated solely to the process of moving inventions from within the university to industry partners, including start-up companies, for commercialization. Many universities have established research foundations to improve the technology commercialization process and to facilitate university industry collaboration. While technology transfer offices and research foundations often serve the same purpose (i.e., commercializing university technology), the research foundation, a separate legal entity with its own managers and commercially-focused board of directors, is often better suited to collaborate with industry and is not encumbered by university policies created for academic purposes. They are often able to provide legal protections for research sponsors that are problematic to state-owned universities, and they can hold equity in licensee start-up companies.

Corporations and universities often hire personnel with technical, business, and patenting expertise in their offices that handle patents and make licensing decisions. Some employ lawyers and business experts with technical expertise and with experience in patent law and negotiating contracts. Individuals with undergraduate or graduate degrees in various scientific disciplines, who have experience or expertise in marketing and communications, seem to be particularly adept at technology commercialization. Inventor employees

are required to report (often referred to as *disclose*) inventions to the appropriate department or office and to collaborate with the department to find potential uses for the invention, draft and prosecute patent applications, and find potential buyers or licensees. The technology transfer or business development office usually has final decision-making authority regarding whether to patent an invention and how to market or license it. However, inventors who collaborate with these departments can influence decisions, be a part of the commercialization process, and increase the likelihood of their invention's success.

11.6. PATENT VALUATION

Prior to the 1980s, the total value of public companies, as evidenced by their stock prices, was approximately 80 percent tied to the companies' tangible assets (such as buildings, inventory, cash, and equipment). In the 2010s, the reverse has occurred: The total value of companies is roughly 20 percent tied to tangible assets and 80 percent tied to intangible assets, like patents, copyrights, trade secrets, knowledge, and know-how. Effective company managers are careful to develop and manage intellectual property, because increasingly it is the asset that determines company performance and value.

Like any other form of property, a patent has a quantifiable monetary value. This value is reflected in the stock price of large companies and in the valuation of private enterprises. To be effective managers and to adequately provide metrics of performance, it is important to be able to have a reasonable assessment of the company's intellectual property value. Valuation of intellectual property may be even more important for small start-up companies seeking investment based on their patents. As people invest money in a start-up, the amount of stock they receive is determined by how much they invest relative to the start-up's current value. And how much the start-up is already worth is closely tied to how much the start-up's patents and other intellectual property are worth.

The valuation of patents is difficult, unless you have actually negotiated a transaction in which a buyer and seller have agreed as to a value. Appraisers value real property (land and buildings) and personal property (such as cars and clothes) by using comparisons (market approach) of similar properties. This is more difficult with patents, which by definition are unique and thus less comparable. Appraisers use an income approach wherein they estimate future profits over the period of time the property is expected to generate profits. They then take this future stream of profits; and by discount methods, which take into consideration the time value of money and interest

rates, they establish a current fair market value for the property (i.e., the patents). However, predicting the future profits of a patent tends to be elusive. Thus, valuation is a continuing challenge as accountants and managers struggle to place a reasonable fair value on patents when creating balance sheets to report to management and shareholders, when estimating the value for investment and tax purposes, and when assessing performance of company leaders.

CHAPTER 12

FOREIGN PATENTS

Patents are granted by individual sovereign nations. No country can control or limit the use of inventions (and innovations) outside of its borders except by international agreement. Given the fact that there are close to 200 sovereign nations, each with its own perspective on the roles and rights of inventions, there are myriad issues and complexities related to foreign patents. We wish to summarize some of these in this chapter.

Like the United States, most countries offer utility patents for inventions that are useful, novel, and unobvious, although some countries may have different terms for these requirements. Members of the European Union, for example, require that patentable inventions be *new*, have *industrial applicability*, and evidence an *inventive step*. (See Section 12.2 for details.)

As in the United States, foreign patents are generally available to an inventor or his assignee and last for 20 years from the date of filing the application. Some countries, such as Japan and some members of the European Union, offer a five-year extension on the patent term for pharmaceuticals. At least 75 countries, including China, Japan, and Germany, have a special type of patent, known as a utility model or mini-patent, that requires only a minor improvement over the current state of the art. This gives inventors short-term protection, generally somewhere between six and 14 years, for minor improvements upon existing technology.

12.1. DISTINCTIVE FEATURES OF U.S. PATENT LAW

While the United States' switch to a first-inventor-to-file system has helped to harmonize U.S. patent law with the patent laws of most other countries, U.S. patent law has several distinctive features that are not shared by many other nations, including the best mode requirement, the one-year rule, and the continuation-in-part application. (These matters are discussed in Section 5.4.2.1 and 6.5, respectively.) While U.S. patent law requires inventors to disclose the best mode they have found for making their invention in a U.S. patent application, many other nations do not have this requirement. For example, European patent law requires inventors to disclose at least one mode of making or using an invention, but this mode need not be the best mode the inventor has found.

In U.S. patent law, the one-year rule allows an inventor to file a patent application on an invention he disclosed for up to one year after the disclosure (see Section 5.4.2.1). Patent law in many foreign countries, particularly European nations, is far less forgiving of early disclosures by an inventor. For example, under European Patent Office rules, an invention must be novel on the date it is filed based on all public disclosures, unless the discloser has signed a non-disclosure agreement with the inventor. Thus, an early disclosure by an inventor in a presentation or journal article destroys patentability in Europe. Similarly to the United States, Canada and Mexico have a one-year grace period for disclosures made by the inventor who is seeking the patent.

On a similar note, most countries do not have a continuation-in-part (CIP) application (see Section 6.5.2). CIPs maintain the priority date of an earlier parent application, but disclose new information that allows the patent to contain new claims. Because the CIP can have a priority date that relates back to the earlier parent application, it also means that the parent application does not destroy the novelty or unobviousness of the CIP's claims. Most countries do not allow an inventor to maintain an earlier priority date unless the inventor enabled (i.e., taught) the new invention he is claiming by disclosing it in an earlier application. All disclosures must be made in the initial document or the inventor must file the new development as a completely separate patent application. This is particularly troublesome because a later application may be obvious in light of the inventor's earlier patent application if the earlier application has already been published. Thus, inventors who plan to file abroad are encouraged to protect as many developments as possible with provisional applications and to delay the filing of a regular patent application until the inventor is relatively certain that most of the potential claims have been reduced to practice.

Despite these differences, similarities in patent law have led many countries to enter international agreements to harmonize patent laws and make patent filing easier for inventors.

12.2. THE INTERNATIONAL PATENT COOPERATION TREATY

There is no such thing as a *world* or *international patent*. However, the Patent Cooperation Treaty (PCT) created a unified procedure for filing patent applications in most of the world's major industrialized nations. Collectively, the signatories to the PCT are known as the International Patent Cooperation Union and they have agreed to accept a single standardized application. At the time this book was printed, 143 countries had signed the PCT, including the United States. To start the PCT process, an inventor files a single PCT or *international application* in the PCT receiving office (in Virginia for U.S. inventors) in the inventor's national language. The application establishes a filing date in all PCT countries and can be translated into other languages for use in foreign application processes.

12.2.1. PCT Examination Procedures

Based on the PCT application, the International Searching Authority (ISA) carries out a prior art search and issues a preliminary report on patentability. While some countries rely on this report, it is not a binding decision. Within three months of when the ISA issues its report, a patent applicant can demand additional patent examination by the International Preliminary Examining Authority (IPEA). This is essentially an appeal of the ISA's decision; and during this stage the patent applicant has additional rights, like the right to turn in written arguments, speak directly with an examiner, and amend the application. Like the ISA report, the conclusions of IPEA's preliminary report are not binding on national and regional patent offices. However, an inventor might want to appeal because some countries rely heavily on the ISA and IPEA reports when deciding whether to grant a patent.

Within 30 months of filing the PCT application, patent applicants must enter the *national phase* of patent prosecution in each country in which they wish to pursue a patent. Often, this involves translating the patent into the national language of the country in which the patent is being filed, paying additional filing fees, and beginning communication with the national patent offices. At this time, the PCT application and any preliminary reports on patentability (from the ISA or IPEA) are forwarded to national offices, like

the U.S. PTO, or regional patent offices, like the European Patent Office, that have the authority to make binding decisions on patentability.

12.2.2. Deciding Whether to File a PCT

The PCT application is of little use if an inventor plans to apply for a patent only in a few countries; however, it can lessen attorneys' fees if an inventor plans to file in many countries because it uses a single standardized form. Generally, the PCT application contains most of the information needed to file a patent application in a national or regional office. However, some countries require additional elements that are not part of the PCT application. For example, U.S. patent applications require the inventor's oath in which the inventor attests that he believes himself to be the first and original inventor of the product or process claimed in the patent application.

Inventors and especially patent attorneys also use PCT applications for strategic purposes. PCT applications are examined relatively quickly, so some inventors will file a PCT application at the same time as a U.S. provisional application, hoping that the ISA preliminary patentability search will turn up any prior art the inventor should know about before beginning prosecution in the United States. Similarly, PCT applications can give inventors extra time to decide in which countries they actually want to file, because the PCT application establishes a filing date and is relatively inexpensive. A particularly effective way to delay U.S. patent examination is to file a U.S. provisional patent application, then a PCT application one year later, and then a U.S. application 30 months after the PCT application. This is a relatively inexpensive way to buy almost four years to validate the invention and line up a licensee. Finally, an inventor who files a PCT application and appeals for examination by IPEA can use this review as a trial run for the prosecution strategy of his claims. By working through the issues presented during communication with IPEA, the inventor can develop a more effective plan for prosecuting the patent with the U.S. PTO.

12.2.3. The Patent Prosecution Highway

In addition to PCT procedures of patent filing, many countries, including the United States, have begun to enter into bilateral treaties (i.e., treaties between only two nations) to expedite examination. The U.S. model, the Patent Prosecution Highway, includes treaties with Japan, the European Union, Canada, Australia, and others. These treaties essentially say that if a claim is granted in the national office of the country where the patent application was first filed,

the patent office in the country where the patent was filed second must fast track the examination of that claim so that the claim can be issued quickly in both countries.

12.3. THE EUROPEAN PATENT UNION

The European Patent Convention goes further than the PCT, creating a single centralized authority for granting patents (the European Patent Office or EPO) and some standardized rules governing how patents should be interpreted. Today, 38 countries participate in the EPO, including most European nations and some states of the former Soviet Union. While the intellectual property and innovation systems would be more efficient and effective if Europe were to have a single patent that covers the entire continent, today patents granted through the EPO are just a series of patents granted by the national patent offices of each country.

12.3.1. European Patent Office Procedures

Applicants to the EPO fill out a single application and designate which EPO countries they want the patent to apply to. The EPO then examines the application for *newness* (a standard almost identical to the U.S. novelty requirement), *industrial applicability*, and evidence of an *inventive step*. Industrial applicability requires that an item can be made or used in commerce or agriculture (a standard slightly higher than utility in the United States). Much like the U.S. utility requirement, industrial applicability is a non-issue in the majority of cases, but could limit the patentability of things like gene sequences with no known therapeutic purpose. The inventive step (the European Patent Union equivalent of unobviousness) is explored using a different test than the one used in the United States. An examiner in the European Patent Office uses a three-step process, known as the *problem-and-solution approach*, which first looks for the single piece of prior art that is closest to the invention claimed in the patent application that is being examined. Once this closest piece of prior art has been identified, the examiner studies distinguishing features between the patent application and the prior art to figure out what technical problems the patent applicant overcame. Finally, the examiner asks whether someone skilled in the art *would* have necessarily adapted the prior art the same way the patent applicant did in order to solve the technical problem. While the inventive step standard is almost as fuzzy as the PHOSITA standard used in the United States, the inventive step is narrower than unobviousness because it looks at only one piece of prior art and asks whether an ordinary

scientist *would* have overcome the technical problem in a particular manner, not whether a scientist *could* have overcome it that way.

12.3.2. Nationalization of European Patents

When a patent is granted by the EPO, it is issued as a series of national patents in each designated country through a process called *nationalization*. During nationalization the patent is translated into the language of the issuing country and the country's patent office issues a patent. A few countries, like France, Italy, and the Netherlands, require inventors to apply for a patent through the EPO, but most European nations will allow inventors to file patents directly in the national patent office. The national procedures tend to be faster, while the EPO procedure is cheaper. Belgium does not examine patents. The EPO examines Belgian patents, even those that go directly to the Belgian Patent Office. A patent sought only in Belgium can be for either six or 20 years, depending upon how much the inventor is willing to pay for protection.

Unlike the EPO's centralized application rule, the procedures after a patent is granted in EPO countries are noncentralized. Infringement and post-grant amendments to the patent are controlled by the national laws of each country, not the EPO. Thus, patents granted through the EPO may start out the same, but some may be disallowed or altered by amendment. The European patent process has been compared to identical twins, which start out life the same but may grow up to be very different.

12.4. OTHER FOREIGN PATENT PRACTICES

12.4.1. Claims Interpretation

Another way in which patents may differ between European nations or between countries throughout the world is in how the claims are interpreted by courts. As previously discussed in Section 5.6.3, the claims define the scope of the patent, determining, for example, whether an inventor has the exclusive rights to all hybrid automobile engines or just to hybrid electric engines configured like Toyota's Prius engine. Traditionally, there have been two major approaches to interpreting patent claims: the narrower English approach, which is used by the United States, and the broader German approach. Under the English approach, courts interpret claims narrowly and literally, and external information is only considered when the claims are ambiguous. The English approach is thought to give greater certainty to third parties, because judges have less interpretive leeway and a potential infringer only needs to look at the claims of a patent to determine whether they are infringing.

Under the German approach, a court can almost rewrite claims based on its understanding of the invention drawn from the specification, drawings, and industry standards. The German approach gives broader protection to patent holders by considering all the data given to the patent office.

12.4.2. Patent Examination Procedures Abroad

A few countries have patent examination procedures quite different from U.S. prosecution. Australia, Canada, and Japan all have delayed examination, waiting at least a year after a patent is filed to examine it. When these countries do examine, they may rely upon patentability searches performed by other countries' patent offices. Particularly, Canadian patent examiners tend to look at and rely upon the patentability determinations of U.S. examiners. Japanese examiners also rely on the examination undertaken by other patent offices. Japanese patent applications, which are often translated from English, may include mistranslations that make it difficult to turn up all relevant prior art.

12.4.3. Centralized Patent Offices

Centralized patent offices, similar to the EPO, also exist in other parts of the world, such as the Eurasian Patent Organization, which issues patents for eight former Soviet countries including Russia, Armenia, and Belarus. The African Regional Intellectual Property Organization examines patents and registers copyrights and trademarks for 18 African countries.

12.4.4. Procedures for Rewarding Inventors

Japan and Germany have specific statutory provisions for rewarding inventors whose research has led to great commercial success. Much like in the United States, Japanese patent law presumes that companies own inventions made by their employees within the scope of their job duties. However, Japanese researchers are entitled to *reasonable* compensation if they assign a patent to their employer. If there is no agreement as to compensation or if the compensation given is deemed unreasonable, the Japanese courts can (and have) awarded employees "reasonable" compensation based on the profits made for the employer, the contribution made by the employee, and how the employee has been treated. A Japanese court awarded one employee 840 million yen (about \$11 million U.S.) for an invention that led to the development of a blue light-emitting diode. The German patent system uses a formula to determine how much inventors should be compensated for their work. Under the German Employees' Inventions Act, an employee inventor gets a percentage

of the estimated value of her invention based upon the position and duties of the inventor and the degree of company involvement in the invention's creation. These practices differ greatly from the U.S. patent custom under which inventors and employers negotiate the terms of their relationship without government intervention, and typically there is no additional compensation to the inventor other than perhaps a recognition plaque or a nominal fee if the inventions have great commercial success.

12.5. ENFORCING PATENTS ABROAD

Even though all countries have the right to issue and enforce national patents, inventors should be aware of challenges in enforcing some international patents. This problem has been particularly acute with patents granted by China and India. China's intellectual property system began with the passage of its patent act in 1984. Legal scholars have noted that, while China extended intellectual property *rights* in the 1980s, it did not have sufficient enforcement mechanisms in place to meaningfully protect these rights. As a result, many of China's corporations and citizens continue to ignore and even flout patents, copyrights, and trademarks. India has a long history of patent law, stretching back to its time as a British colony, but modernized its patent act only in 1970. However, India's patent office is understaffed and has a high attrition rate. Perhaps as a result, India's patent examiners grant patents on a high percentage of the applications they receive, leading to patents that are often unenforceable. Chinese and Indian patent laws also contain provisions that weaken patent protection, such as compulsory licensing (also known as mandatory or statutory licensing that requires the patent owner to license to specific licensees for a pre-determined royalty), and rules stating that it is not infringement if an inventor either (a) uses a patented invention solely for scientific research or (b) imports pharmaceuticals or medical devices to conduct studies required for regulatory approval. In the past decade, western nations have used trade negotiations and economic sanctions against China and India as leverage to encourage stronger patent protections, which have improved patent enforcement to some degree. Both countries felt particular pressure to improve their patent systems so they could be included in the World Trade Organization's Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS). In response to TRIPS, China removed legal provisions that treated Chinese entities different from foreign entities, increased the maximum fines available for patent infringement, and allowed courts to order the temporary stoppage of potentially infringing activity during a lawsuit. India began allowing patents on pharmaceuticals and chemicals, and it added pre-grant proceedings to its administration of the patent system.

Some are concerned that many of these reforms are merely quick fixes to comply with international agreements or to show good faith in trade negotiations. However, some commentators on foreign patent policy have noted that, in their haste for lower production costs, companies often rely heavily on Chinese and Indian courts to enforce patent law, rather than using internal security procedures that would keep patented inventions relatively safe.

12.6. CHOOSING WHETHER TO FILE A FOREIGN PATENT APPLICATION

Very few inventions obtain worldwide patent protection. Most inventors, consulting with their attorneys and technology transfer offices, choose just a few countries in which to file patent applications and pursue protection. After all, most inventions are not worldwide sensations, and even inventions that are eventually used around the globe may not be commercialized in every country within the 20-year patent period. In choosing whether to file a patent application in a particular country, an inventor must weigh the cost of filing the patent (e.g., translation fees, filing fees, attorneys' fees, and taxes) plus the cost of maintaining the patent (e.g., maintenance fees and the cost of paying an attorney to sue infringers) against the revenue the patent is likely to generate. An inventor may look at the country's economy and the size of the market for the particular product or process, as well as specific business prospects and licensing opportunities. The inventor should also consider the amount of protection the patent will provide. In countries that do not rigorously enforce patent laws, the value of having a patent is diminished. To make matters even more complicated, inventors need to think about these factors not just on the date of filing, but also as they are likely to develop over the next 20 years. For example, China has improved its patent enforcement practices steadily over the past decade. While patent protection may not be particularly strong for some technologies today, China is likely to enforce the patents more rigorously in the future. Similarly, some countries that have a relatively small medical market today may show rapid growth over the next decade and present a strong financial opportunity for a decade before the patent has expired.

CHAPTER 13

INNOVATION

A few thoughts on *innovation* to science and engineering graduate students who, as employees with technical backgrounds, will have tremendous expectations placed on them by employers striving for improved performance.

Innovation is now part of the vocabulary of scholars, industrialists, and government leaders. While many definitions of innovation have been proposed, there is no universally accepted definition. Innovation, for our purposes, is the *translation of an invention or an idea into a product or service to the marketplace*. Or, a more pragmatic formulation: Innovation is *anything that generates cash flow*.

13.1. INNOVATION IS MORE THAN INVENTION

A few years ago, the National Science Foundation sponsored extensive investigations to better understand the innovation process and how innovation is supported by science and technology. It was stressed that innovation and invention should be differentiated, although invention frequently results in the initial concept leading to innovation. Innovation was defined as a complex series of activities beginning when the original idea is conceived (conception),

proceeding through a succession of interwoven steps of research, development, engineering design, market analysis, management decision making, and so on, and ending when an industrially successful product (which may be a thing, a technique, or a process) is accepted in the marketplace.

13.2. WHAT DRIVES INNOVATION

The most important conclusion of the NSF study was that innovations happen due to the personal efforts of a *product champion* (or the *technical entrepreneur*), the driving motor in an organization who champions the scientific–technical–managerial activity that results in innovation. Besides the product champion, other important factors necessary for innovation identified were early recognition of need, scientific and technological opportunities, intellectual property protection, adequate financing, supporting inventions, effective management, and planned or unplanned confluence of technology.

13.3. THE LAW OF INNOVATION

Just as we defined invention with mathematical expressions (laws) in Chapter 5, the following equation, the law of innovation, expresses the essentials for innovation:

$$I = C + E$$

where *I* is innovation, *C* is conception, and *E* is entrepreneurship, which embraces the product champion plus the above mentioned factors.

By definition, there are no unsuccessful innovations (only more or less successful innovations) but there are many economically worthless inventions. To put it succinctly: Research transforms money into knowledge, while innovation transforms knowledge into money (Figure 13.1):

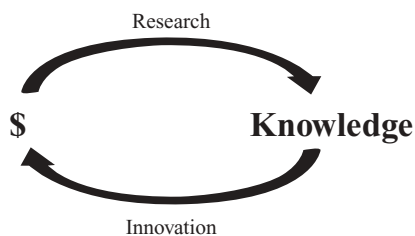


FIGURE 13.1. Money buys research and generates knowledge; knowledge leads to innovation, which leads to money.

13.4. COMPANIES AND INNOVATION

It is an interesting paradox that companies generally recognize the need to innovate in order to survive; nevertheless, many tend to be hostile toward innovation. Innovation by some may be seen as dangerous to the status quo, particularly in mature corporations. The most difficult phase of innovation is often the transfer of a new product or technology from the laboratory to the operating divisions, such as manufacturing, marketing, sales, legal, and financing divisions. A typical operating unit in a company may be focused on operational performance, quality, and efficiency and may reject innovation because it can be threatening to their status quo. Consider an engineering division, which is organized to produce things efficiently for immediate consumption. The division may be reluctant to experiment with an untried product or process. Similarly, a manufacturing division may be reluctant to take a risk with untested products or processes. Sales people may be reluctant to spend time educating themselves or their customers in regard to new products because they may not sell as fast and easily as the old ones. Unions may resist improvements that create increased productivity yet reduce labor requirements. And a company vice president of production may calculate that the innovation will take a long time before it becomes profitable, if at all, and by the time it generates a return on investment, he will be in retirement. Thus, through organizational inertia, some mature smoothly running companies tend to reject even promising innovations. There is a voluminous body of literature on how to overcome this organizational inertia and to organize for efficiency; however, this is beyond the scope of our inquiry.

A society's quality of life continues to be a function of successful innovation. Those who successfully innovate, even more so than those who invent, will create and experience greater wealth. Societies who fail to innovate also fail to reach their potential for higher quality of living, particularly over the long term. Consider, for example, the amount and quality of food produced by so relatively few in the twenty-first century, due to technology innovations of plant and animal varieties, soil care and fertilizers, equipment, and water distribution; business innovations such as financing and organizational structures; and legal innovations (co-ops as an example) that result in improved productivity. Consider your improved capacity to produce and interact with others through the recent innovations of telecommunications, miniature mobile devices, the Internet, and electronic libraries.

13.5. THE INNOVATION AND JOB CREATION RELATIONSHIP

Innovation is also recognized as a pathway to job creation. Jobs are available to those who produce value that is recognized by those who are willing to pay for the value. Transactions occur as "value" of comparable worth is

exchanged. Thus, an employment agreement (transaction) happens when (1) the cost of acquisition (cost of recruiting, salary, startup, operation to support) is equal to or less than the perceived value of the benefit (the employee's knowledge and services) and (2) the service (or product) is provided at a more favorable price than that provided by similar providers. As a result, productivity (producing goods or services valued by others) becomes the key to job creation and retention. It is based on the basic economic premise of equal value exchange. If I produce value to you such as providing food, then you will provide value back to me with whatever you have that I value, for example, tutoring. Society has developed money (currency) as an innovation that acts as a common representation of value. Money is accepted as payment for goods or services because the receiver knows that she can use it to purchase other goods or services, or invest the money to receive additional value.

13.6. DISCOVERY PUSH VERSUS MARKET PULL INNOVATION

Innovation is a process that usually occurs over time rather than a single event. Innovation is often characterized as a linear sequence of events emanating from one of two starting gates. The first starting gate—that is, the *discovery push model*—is an invention that occurred because it was interesting (or serendipitous), but was not meant to meet a specific need or to solve a particular problem. The second starting gate—that is, the *need or market pull model*—is an invention that results from persons attempting to meet a specific need or find a solution to a specific problem. (See Langrish, Gibbons, Evans, and Jevons, *Wealth from Knowledge*, Halsted Press Division, John Wiley & Sons, Inc. New York 1972, pp. 72–73.) Innovations resulting from market pull are more frequent than discovery push innovations and are far more likely to result in economic reward. However, let our basic research colleagues not despair, because if and when discovery push occurs, the innovation is more frequently disruptive and has the potential to significantly change how we live and produce. As an example, when the laser was first invented, there was little appreciation for its eventual uses.

13.7. INCREMENTAL VERSUS DISRUPTIVE INNOVATION

Innovation is often characterized as either *incremental innovation* or *disruptive innovation*. Incremental innovation has to do with improvements to a particular system, while disruptive innovation makes a system obsolete and replaces it with something better. An automobile electrical systems manufacturer may be seeking a lighter electrical conductor to help reduce the weight

of a car and thus improve energy efficiency. Such an improvement is considered incremental innovation. On the other end of the spectrum, the Internet is a disruptive innovation, which changed such diverse industries as cable and broadcast television, telephones, newspapers, publishing, music, education, and all types of sales industries. To illustrate, the traditional “paper news” industry became largely obsolete due to the improved means of sourcing and distributing news via the Internet. The Internet disrupted the newspaper publishing business. The buggy whip business became obsolete when cars became the preferred means of transportation over the horse and buggy. The automobile was a disruptive innovation. The personal computer is a disruptive innovation.

13.8. SOURCES OF INNOVATION

Innovation is usually sourced from either industry researchers (persons who are hired to innovate), academic researchers (scholars hired to push the boundaries of knowledge often regardless of solving a societal problem), or the independent inventor. Independent inventors tend to tinker at home and occasionally develop a great invention or solution to a specific problem. The academic inventor tends to pursue basic research, which often has little potential for innovation. The industry inventor is usually laser-focused on creating value. However, industries are accused of focusing too much research on short-term returns as opposed to investing in research that will pay long-term dividends.

Innovations often emerge when deeply held conventions are challenged or when an innovator sees the potential of technology and change. Successful innovators understand and anticipate needs of customers and end users. They tend to view their organizations as bundles of assets that can be reallocated or recombined to create new and improved goods and services.

13.9. INNOVATION AND PUBLIC POLICY

We have seen a plethora of innovation-related initiatives hosted by institutions, companies, municipalities, states, regions, and nations within the past 20 years. The U.S. government has been the primary funder of basic research for many decades, leading to numerous inventions and innovations. Consider the list of 50 important innovations and discoveries funded by the National Science Foundation (NSF) in its first 50 years, as reported by NSF. This list includes inventions and innovations that became platforms for commercial products and services and that are widely used, such as barcodes, CAD/CAM

software, data compression technology used in compact discs, and even the Internet (which the NSF funded along with DARPA, a defense research agency).

Since 1982, the federal government has also sponsored Small Business Innovation Research (SBIR) grants to support innovation in small enterprises. The SBIR program supports scientific and technological innovation in critical national priorities related to economic development, defense, health, energy, and other national interests. The program provides financial support for some of the best early-stage innovation ideas, which at times are still too high risk for private investors.

More recently, the U.S. federal government shifted some of its resources and focus to downstream commercialization rather than to upstream funding for basic research. For example, the U.S. Department of Commerce, Economic Development Administration, Office of Innovation and Entrepreneurship in 2012 sponsors challenge grants to programs that improve innovation and entrepreneurship in various regions of the country. There is significant debate as to the appropriate role of the private sector, as well as the role that local, regional, or federal governments play in filling gaps in the innovation ecosystem. The private sector in general is less effective at sponsoring basic research and more effective at applied research and commercialization, whereas the government is less adept at innovation and commercialization and is more effective in sponsoring basic research. The federal government also is effective at providing gap funding for inventions that need a few resources to validate the technology and prove the concept.

CONCLUDING THOUGHTS

14.1. IS THE PATENT SYSTEM WORTH THE COSTS?

The patent system is of great benefit to society, because it fosters the creation and commercialization of significant innovations that continue to improve the human condition (Figure 14.1). An appreciation of the patent system is essential for emerging technical professionals to effectively contribute to the innovation ecosystem, as well as to their employers. We are fortunate to be the beneficiaries of wise forbearers who authorized intellectual property systems through the U.S. Constitution and created the patent system.

It is true that there is a cost to implementing the patent system. It does limit exploitation of innovation by some parties for a period of time. It is also costly to maintain the patent infrastructure including the patent office, patent professionals including attorneys and agents, and the patent-related courts. However, such disadvantages are offset by the value created via incentives leading to innovation. But for the patent system, many inventions would not have attracted sufficient investment to be created and developed.

Notwithstanding, the case has been made that the patent system is also an innovation inhibitor—particularly in such fields as information technology, where large systems often require thousands of innovations. The disruption by



FIGURE 14.1. A patent protects an innovator from the natural yet predatory instincts of competitors in our free-enterprise system.

any patent owner of one of the needed innovations can hold up the system and threaten the investment. This is arguably exacerbated by what some authors call inappropriately awarded patents that have resulted from an “overly pro-patent judiciary.” And this is further complicated by an increasingly litigious business system.

All things considered, the authors believe the patent system cost is acceptable given the exceptional value generated. Improvements are always possible and should be encouraged. The system generally achieves a reasonable balance between (a) the conflicting objectives of limiting others from making, using, or selling an invention so that investment is incentivized and (b) the objective of having all science and engineering publicly available

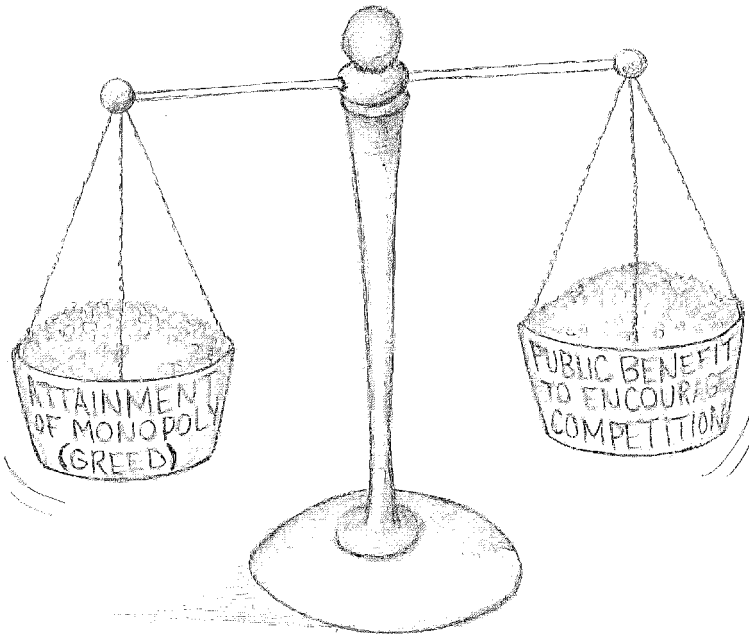


FIGURE 14.2. An appropriate balance between the inventor's personal enrichment and societal need is established by patents.

so that the collective human knowledge base grows for society's benefit (see Figure 14.2). Because of the patent system, talented and usually well-educated inventors have the incentive to connect emerging science and engineering to existing or anticipated markets.

14.2. THE PATENT SYSTEM LEADS TO ADDITIONAL RESEARCH AND KNOWLEDGE CREATION

It is of interest to contemplate that although the patent system rewards only applied science, the profits derived from patents often promote and support fundamental science. Just think of the Nobel prizes, the most generous and prestigious awards of basic science, sustained by the profits generated by Alfred Nobel's patents on dynamite.

Effective inventors understand the basics of creating and protecting inventions. They also know when to reach out to professionals who are well trained in intellectual property and innovation. Increasingly, inventors and their employer companies or institutions are responsible for wealth creation based on technology and innovation.

14.3. FOSTERING COMPETITION

One of the consequences of the patent system is that it strongly fosters competition, which is of great benefit to society. Consider, for example, that Company A invents, protects its inventions by patents, and successfully introduces into the market Product X. In due time, Product X becomes a successful innovation and generates significant cash flow for Company A. Company B, which sells its product line into the same market as Company A, becomes aware of Product X and realizes that it could also produce and sell a very similar product; however, it is barred from doing so by Company A's strong patent position. Company B tries to license Product X from Company A. However, it is rebuffed: Company A does not want to license this product. What is Company B to do?

After a thorough analysis of its technical capabilities and the market, Company B decides to charge its research department to *invent around* Company A's patent and to develop its own Product Y to compete with Product X. To effectively compete with Product X, however, Company B's Product Y must be at least as good as, if not better than, Product X and must of course be protectable by patents. Researchers and engineers at Company B go to work, and after a time they are able to develop Product Y with excellent properties. Product Y is introduced into the market, and it becomes a strong competitor to the pioneering Product X of Company A. The significant business advantage of the second comer Company B over that of pioneering Company A is that Company A had to invest a lot of money to create and develop the market (a very expensive and risky undertaking) for its pioneering Product X. Company B will save the cost of creating a market for its Product Y and will find a mature market already developed for its similar competing product.

This sequence of events occurs frequently and is very desirable for society at large. One of us (JPK) was involved (albeit in a minor role) in such a situation while working in industry. Briefly these were the events he witnessed: Researchers in Hermann Staudinger's (the father of polymer science and a Nobel laureate in 1953) laboratory observed in the late 1920s and early 1930s that formaldehyde, a very inexpensive but noxious and corrosive gas, can be easily polymerized to polyformaldehyde (also called polyoxymethylene or POM), a white thermoplastic material. Regrettably, this POM was thermally extremely unstable and would rapidly decompose (depolymerize) back to formaldehyde even when stored in the laboratory at ambient temperatures. Thus, it is no wonder that POM remained a laboratory curiosity until around 1952 when researchers at DuPont figured out why this interesting, inexpensive resin was so unstable, and they were able to stabilize it by chemically modifying ("end capping") the basic POM molecule. To cut a long story short, DuPont received patents in 1956 on the modified-stabilized POM resins, and

the product was commercialized in 1960 under the trade name Delrin. Indeed, Delrin became a most successful innovation used in hundreds of applications (e.g., television and telephone housings, mechanical parts, springs, hinges, locks, wheels, and furniture).

In the meantime, Celanese, another giant chemical company and a competitor of DuPont, was also heavily engaged in the chemical research of formaldehyde. Having heard of the great commercial success of Delrin, Celanese management also decided to develop a POM. After several years of research, Celanese's technical people came up with a copolymerization method (by the use of formaldehyde plus small but critical amounts of ethylene oxide or similar compounds) that yielded a copolymer product, which exhibited an even better combination of properties than DuPont's Delrin in certain respects. Importantly, the composition of Celanese's POM was sufficiently different from that of Delrin and its copolymerization process was also new. Thus, Celanese also obtained patents on its POM. In 1963, Celanese entered the market with its POM under the trade names Celcon and Hofstaform. These high-performance engineering plastics also became very successful innovations, which generated a lot of jobs and a good stream of revenue for Celanese, as well as improved products for consumers and industrialists. This example shows how Celanese invented around DuPont's existing product to create an even better polymer.

14.4. RESULTS OF IGNORANCE OF THE PATENT SYSTEM

We submit that ignorance of the patent system may have devastating consequences. This conclusion is well illustrated by the history of the first antibiotic, penicillin, arguably the greatest discovery in medicine in the twentieth century. Penicillin was discovered accidentally in 1928 by Alexander Fleming (a Scottish professor of microbiology, Nobel Prize winner in physiology and medicine in 1945). Unfortunately, Fleming rushed to publish his observations and did not bother with patenting because he wanted to dedicate his discovery to humanity. Due to Fleming's apparent ignorance of or disregard for the patent system, humankind had to wait for more than a decade before companies had sufficient financial incentive to invest in penicillin, which became a life-saving treatment for millions of people. Had Fleming protected (patented) penicillin, companies perhaps would have had incentive earlier to invest in developing and manufacturing the therapy and humankind could have had the treatment much earlier. Mass production of penicillin started only in 1945, after companies discovered patentable manufacturing processes for the drug.

Fleming's failure to patent was referred to during the famous senate "Drug Hearings" in 1960. The following exchange of words took place between

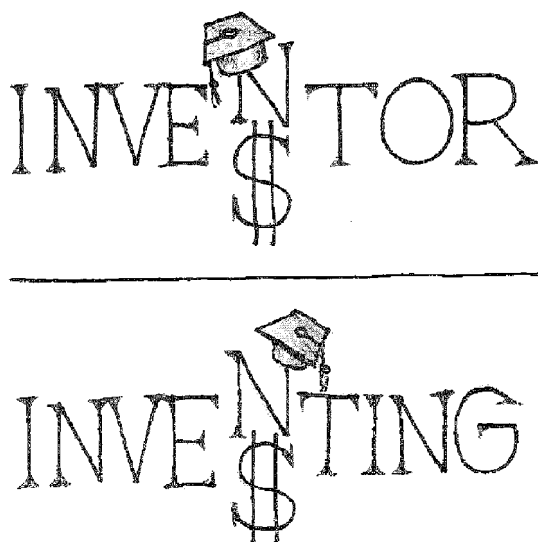


FIGURE 14.3. Inventing and investing go hand-in-hand. Patent protection leads to investing. In the absence of patent protection, investors are reluctant to invest.

Senator Kefauver and Dr. Vannevar Bush, the Head of the Office of Scientific Research and Development during the World War II penicillin effort and subsequently the chairman of Merck's Board of Directors:

Sen. Kefauver: Suppose Dr. Fleming had taken out a patent on penicillin?

Dr. Bush: Ah, if he had, we would have had penicillin ten years earlier than we finally got it.

Dr. Bush's response implies that in the absence of patents, companies are reluctant to invest and industrial development is stymied (Figure 14.3).

14.5. HOW LAW AND TECHNOLOGY YIELD PATENTS

The patent tree in Figure 14.4 illustrates the relationship between the main components of the patent system. The two principal roots of the patent tree are *law* and *technology*, whose confluence yields the trunk (*patents*), which sprouts numerous branches bearing desirable fruits—that is, wealth, jobs, new knowledge, investment, useful new products, and technology.

Emerging scientists and engineers would do well to recognize that misuse of and failure to develop patents and other intellectual property are now seen as threats to economic and physical security. Learning all that one can learn

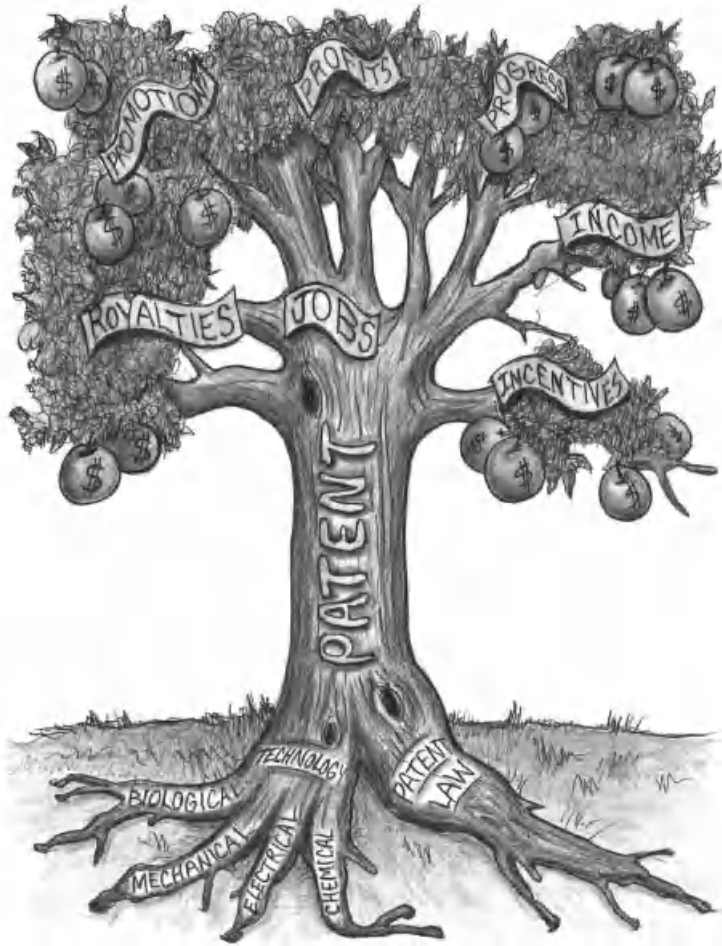


FIGURE 14.4. The patent tree: The patent unites technology and legal principles to produce numerous societal benefits. Please see color insert.

about the topic of inventing can lead to an outstanding career, as well as an opportunity to improve individual and collective security. One should develop and nurture the process for inventing and successfully apply it to one's own circumstances.

Innovation accelerates our economy and enriches our society, and it will continue to do so. Certainly, innovation has accelerated the “opening up” of nation's borders with Internet access and communications. Quality education will increasingly become available to more of the world population, and more people will have the opportunity to invent. This is a direct result of the innovation of the past few decades. Consider how your life is different in so many respects because of recent innovations in personalized medicine,

personal computers, communications connectivity from most any place in the world, and instant access to knowledge from any person on earth who takes the time to post what they know or are willing to teach online.

Our wish and challenge to you is that you will become a contributing member of the class of scientists, engineers, and related professionals that improves life on this planet by creating new knowledge, new products, and even new services that can be developed and implemented as a result of the patent system.

Happy inventing and innovating!

APPENDIX 1

IMPORTANT FORMS

The following are sample forms and contracts you may encounter as an inventor. They include:

- A. Invention Disclosure Form—used when a researcher wants to reveal a potentially patentable invention to his organization’s legal department, technology transfer office, or research foundation
- B. Material Transfer Agreement—used when unpatented products or know-how are disclosed to a company by an inventor for purposes of having these products or techniques tested or further research and development
- C. Employment Agreement—a typical agreement an employee might be expected to sign when he is hired defining the employer and employee relationship
- D. Patent Assignment Agreement—gives an employer or another party ownership over an inventor’s patent
- E. Non-Disclosure Agreement—requires a party to keep information confidential and allows an inventor to prevent a third party from discussing an unpatented invention the inventor shares with him and is often used to share trade secrets or ask a potential licensee about the value of pursuing a patent

- F. Information Disclosure Statement—must be included in a patent application to disclose any relevant prior art references
- G. Inventor's Oath—must be included in a patent application and states that the inventor believes he and his co-inventors are the first to invent
- H. Patent License Agreement—a patent holder allows another person or company to make, use, sell, or import the invention in certain circumstances in exchange for a licensing fee
- I. Sponsored Research Agreement—used by people or companies who want to pay another person or company to do research on their behalf
- J. Joint Ownership Agreement—establishes the relative ownership rights of multiple co-owners of a single patent

A. INVENTION DISCLOSURE FORM

Date: _____

Basic Information

1. Name: _____
2. Official title or position: _____
3. Title or brief description of invention: _____

4. Grant award or contract number under which work was done leading to invention (if any): _____
5. If the work was done under a grant, contract, or consulting agreement, attach a copy of any pertinent legal documents.
6. Name and address of facility in which invention was made: _____

Contributors

1. List the full name, home address, and citizenship of anyone who contributed to the initial concept for the research leading to the invention:

2. List the full name, home address, and citizenship of anyone who contributed to subsequent development and testing of the invention:

Conception of Discovery or Invention

1. What was the problem you sought to solve, and how did you attack it?

2. First oral disclosure
Date _____ To whom _____
3. First drawings
Date _____ Drawing numbers _____
Attach two copies of the drawings to this form

4. First written description

Date _____ Shown to or read by whom _____

Attach two copies of the written description to this form

Development of Invention

1. Date work on development began _____
2. Date completed _____
3. Who completed development? _____
4. Is there an experimental model? _____
5. Is there a prototype? _____

First Successful Test or Operation

1. Date of first successful test or operation _____
2. By whom was the test conducted? _____
3. Where are the records of the test? _____
4. Who witnessed the records of the test? _____

Disclosure Outside the Organization

1. Was the discovery disclosed outside the organization? _____
 - (a) If yes, what date was the disclosure made? _____
 - (b) To whom was the disclosure made? _____
2. Was the invention used, given or advertised for sale to anyone outside the organization? _____
 - (a) If yes, what date was the first sale made? _____
 - (b) Please give details of the use, sale or offer. _____

Description of Discovery

Attach a description of your discovery to this form. Be sure to include:

- (a) Background information on the purpose of the discovery or invention (i.e., the problem to be solved),
- (b) A detailed description of the discovery or invention (i.e., the solution to the problem) with drawings where possible, and
- (c) A discussion of the advantages of the discovery or invention over what was done before.

Be certain to describe the best way of practicing the discovery or invention and the alternatives to the best way without losing the advantages of the discovery or invention.

Prior Patents and Publications

Please list all closely related prior publications, patents, products or uses:

Signature of Contributors

The foregoing Invention Disclosure, consisting of _____ pages, was read and understood by me on the date opposite my name.

1. Signed: _____ Date: _____
2. Signed: _____ Date: _____
3. Signed: _____ Date: _____
4. Signed: _____ Date: _____
5. Signed: _____ Date: _____
6. Signed: _____ Date: _____

Witnesses:

1. Signed: _____ Date: _____
2. Signed: _____ Date: _____

Note: Do not submit this form unless it bears the original signatures of all contributors and witnesses.

B. MATERIAL TRANSFER AGREEMENT

[First person or organization] agrees to provide *[second person or organization]* with certain materials and know-how for the purposes stated herein under the following conditions:

1. The parties to this Agreement are: *[first person or organization]* (hereinafter, "Company A") and *[second person or organization]* ("Company B"). The research (as hereinafter defined) will be conducted by *[researcher's name]* under the supervision of *[supervisor's name]* (the "Scientist").
2. The Material that is covered by this Agreement includes: *[technology or knowhow that is being transferred]*, which was developed by *[inventor's name]* of Company A, and any related material or associated know-how and data that will be provided by Company A or received by Scientist from Company A (the "Material").
3. The Material is considered proprietary to Company A. Company A shall be free, in its sole discretion, to distribute the Material to others and to use it for its own purposes.
4. The Material shall be used by Scientist in research to study *[research project scientist is undertaking]* (the "Research"). Company B agrees that the Material will not be used for any purpose other than those stated in this Agreement.
5. Company B will reimburse Company A for its costs of producing the Material at the rate of \$*[price for material]* per *[unit material is sold in]* of Material. Company A will have available for Company B a total of *[amount of material available]* of Material.
6. Neither Scientist nor Company B shall distribute, release, or in any way disclose the Material to any person or entity other than laboratory personnel under Scientist's direct supervision. Scientist and Company B shall ensure that no one will be allowed to take or send Material to any other location, unless written permission is obtained.
7. This Agreement and the resulting transfer of Material constitute a license to use the Material solely for Company B's internal research use. Company B agrees that nothing herein shall be deemed to grant to Company B or Scientist any rights under any of Company A or Inventor's patents or any rights to use the Material for any products or processes for profit-making or commercial purposes.
8. The Material will not be used in research that is subject to consulting or licensing obligations of Company B or Scientist to another individual,

institution or business entity unless prior written permission is obtained from Company A.

9. At the request of Company A, Company B will return all unused Material.
10. Company B will inform Company A, in confidence, of results of Research related to the Material by personal written communication or by providing Company A with a draft manuscript describing such results. If Company B's Scientist desires to publish such Research results in a non-commercial scientific publication, Company B will provide Company A with a copy of any manuscript or abstract disclosing such Research results not less than forty-five (45) days prior to any public disclosure.
11. The Material is experimental in nature and it is provided without any warranties and without guarantee that it will not infringe on any other patent or proprietary right.
12. In no event shall Company A be liable for any use by Scientist or Company B of the Material for any loss, claim, damage or liability, of whatsoever kind of nature, which may arise from or in connection with this Agreement or the use, handling or storage of the Material.

[Signature of Company A
Representative]

On behalf of Company A

Title: _____

Date: _____

[Signature of Company B
Representative]

On behalf of Company B

Title: _____

Date: _____

C. EMPLOYMENT AGREEMENT

This Employment Agreement is effective this *[date]* day of *[month]*, *[year]*, between *[employer's name]* ("Employer"), and *[employee's name]* ("Employee").

1. **Employment.** The Employer employs the Employee and the Employee accepts employment upon the terms and conditions of this Agreement.
2. **Term.** The term of this Agreement shall begin *[date employment begins]* and shall terminate at will by either party.
3. **Compensation.** The employer shall pay Employee for all services rendered, a base salary of \$ _____ per year, payable *[pay period, i.e., monthly]*. Compensation payments shall be subject to withholding and other applicable taxes.
4. **Job Duties.** Employee shall serve as the Employer's *[title]* to perform a variety of tasks including *[duties of employee]*. In addition, Employee may be called upon to perform other duties as assigned. The Employer may, from time to time, extend or curtail the Employee's precise services.
5. **Extent of Services.** The Employee shall devote her entire professional time and attention to Employer's business as directed by Employer. During the term of this Agreement, the Employee shall not engage in any other professional business activity without the prior written consent of Employer regardless of whether it is pursued for gain or profit. The Employee, however, may invest her assets in other companies so long as they do not require the Employee's services for the operation of their affairs.
6. **Non-Disclosure of Confidential Information.** The term "Confidential Information" shall mean and include any information, including a formula, pattern, compilation, program, source code, device, method, technique, or process that (i) derives independent economic value, actual or potential, from not being generally known to, and not being readily ascertainable by other persons and (ii) that is the subject of efforts that are reasonable under the circumstance to maintain its secrecy. Confidential Information includes all proprietary information and know-how of the Company, whether or not patented, related to the function, development, use, marketing, operation or modification of any process owned, developed or purchased by the Company. Confidential Information does not include (i) information that is in the public domain at the time the information is acquired by Employee or (ii) information that later becomes public through no act or omission of the Employee.

Employee agrees not to disclose or use any Confidential Information and to use Employee's best efforts to prevent the disclosure or use of any Confidential Information either during the term of her employment or at any time thereafter. Upon termination of Employee's employment with the Company for any reason, Employee shall promptly deliver to the Company, as applicable, all materials, documents, data, equipment, and other physical property of any nature containing or pertaining to any Confidential Information.

7. **Non-Competition.** In consideration of the employment of Employee and the other provisions of this Agreement, Employee hereby agrees that, while she is employed by the Company and during a period of 24 months following the termination of his employment with the Company, Employee will not directly or indirectly compete with the Company or their affiliates in any geographic area in which the Company or their affiliates now do business or in which the Company does business as of the effective date of the termination of the Employee's employment. Notwithstanding the foregoing, the Board may elect, in its sole and absolute discretion, to waive Employee's obligation to not compete after Employee's employment with the Company is terminated. While an employee, Employee further agrees to advise Company in writing of business opportunities and ventures that Employee proposes to become engaged in.
8. **Termination Without Cause.** The Employer and Employee may without cause terminate this Agreement at any time by giving notice to the other party.
9. **Disability.** If the Employee is unable to perform her services by reason of illness or incapacity for a period of more than two consecutive weeks, and the Employer retains the employment of the Employee, the compensation thereafter payable to her during the continued period of such illness or incapacity shall be reduced by 50 percent. Provided the Employee remains as an Employee under the terms of the Agreement, the Employee's full compensation shall be reinstated upon her return to full employment and discharge of her full duties. Notwithstanding anything to the contrary, this Provision in no way diminishes at-will employment. The Employer may terminate this Agreement at any time after the Employee is absent from her employment, for whatever cause, for a continuous period of more than three months, and all obligations of the Employer shall thereupon terminate.
10. **Arbitration.** Any controversy or claim arising out of, or related to, this Agreement, or its breach, shall be settled by arbitration in accordance with the then governing rules of the American Arbitration Association.

11. **Legal Representation.** This Agreement was prepared by Employer. Employee has been advised and given opportunity to seek independent counsel.
12. **Notices.** Any notice required or desired to be given under this Agreement shall be deemed given if in writing sent by certified mail to the Employee's residence or to the Employer's principal office, as the case may be.
13. **Waiver of Breach.** A waiver or modification of this Agreement or of any covenant, condition, or limitation in this Agreement will not be valid unless it is in writing and executed by the Employee and President of the Employer. Evidence of any waiver or modification will not be offered or received in evidence in any proceeding, arbitration, or litigation between the parties.
14. **Intellectual Property and Work-Made-For-Hire.** Employee acknowledges that she has been hired to invent, share ideas, and create works and intellectual property. Employee's services pursuant to this agreement are deemed work-made-for-hire. Employee assigns all rights, title, and interest in all know-how, creative works, and intellectual property invented, authored or otherwise created by Employee which is related to the scope of Employee's employment.
15. **Employer Personnel Policies.** This Agreement incorporates company personnel policies as may be modified periodically by employer. In the event of any inconsistencies between this Agreement and employer personnel policies, this Agreement shall govern.

In witness whereof the parties have executed this Agreement as of the date in the heading of this agreement.

Employee

Date: _____

Employer

Signed by its: _____

Date: _____

D. PATENT ASSIGNMENT AGREEMENT

This Intellectual Property Assignment Agreement (the “Agreement”) is effective this *[date]* day of *[month]*, *[year]* by and among *[inventor’s name]*, a citizen of *[state]* with a residence at *[address]* (the “Inventor”), and *[assignee’s name]*, a *[state]* corporation having a principal place of business at *[address]* (the “Assignee”).

Whereas, the Inventor has patents, knowhow and other intellectual property for *[description of invention]* (the “Intellectual Property”).

Whereas, Intellectual Property can better be commercialized through the expertise of Assignee.

Whereas, Inventor wishes to assign his rights to Intellectual Property to Assignee.

Now Therefore, in consideration of the mutual promises hereinafter set forth, Inventor and Assignee agree as follows:

1. Inventor assigns rights to all Intellectual Property, including but not limited to *[patent and provisional application numbers]* and any Intellectual Property listed in the Appendix.
2. Assignee will provide commercialization, marketing and support services for Intellectual Property. Assignee agrees to use all reasonable efforts to generate revenue from Intellectual Property.
3. Inventor agrees to share additional related technology and knowhow that Assignee may wish to license or utilize under a confidential disclosure agreement.
4. Assignee’s board members will meet periodically to assess commercial potential of assigned Intellectual Property. Any Intellectual Property, which is not being effectively commercialized, may be assigned back to the Inventors by written contract signed by Assignee’s representatives.
5. This Agreement shall bind and inure to the benefit of the parties hereto and their successors and assigns. Neither party may assign this Agreement without the written consent of the other party.

[Inventor]

Date: _____

[Assignee]

Title: _____

Date: _____

E. NON-DISCLOSURE AGREEMENT

This Non-Disclosure Agreement (the “Agreement”) is made and effective this *[date]* day of *[month]*, *[year]* by and between *[inventor's name]*, a citizen of *[state]* with a residence at *[address]* (“Inventor”) and *[company or person receiving disclosure]*, a citizen of *[state]* with a principal place of business at *[address]* (the “Recipient”).

WHEREAS, Inventor possesses certain ideas and information relating to *[nature of invention]* (“Invention”) that are confidential and proprietary, and

WHEREAS, Recipient is willing to receive disclosure of these ideas and information pursuant to the terms of this Agreement,

NOW THEREFORE, in consideration for the mutual undertakings of the Inventor and Recipient under this Agreement, the parties agree as follows:

1. Disclosure

Inventor plans to disclose and Recipient plans to receive confidential and proprietary information of Inventor relating to the Invention for the purpose of *[reason Inventor is disclosing to other company or person]*. Information protected under the terms of this Agreement (“Confidential Information”) consists of Invention-related technical and business information that Inventor maintains in confidence, that Inventor discloses to Recipient, and that Inventor identifies as confidential at the time of disclosure to Recipient. Confidential Information disclosed in written form shall be so labeled, and in any other form whatsoever, including oral and electronic forms, at Recipient’s request, shall be summarized in written form labeled “confidential” and provided to Recipient within *[twenty (20) days]* of such request.

2. Confidentiality

- (a) No Use. Recipient agrees not to use, manufacture or test any product related to the Confidential Information other than for purposes of its business with the Inventor. Confidential Information furnished in tangible form shall not be duplicated except for purposes allowed under this Agreement.

- (b) No Disclosure. Recipient will not disclose, publish or reveal the Confidential Information except to Recipient officers, employees, or such other parties to whom Inventor may grant written authorization to disclose, publish, or reveal information.

3. Limits on Information Deemed Confidential

Confidential Information does not include information:

- (a) of which Recipient had knowledge prior to receipt from the Inventor,
- (b) that Recipient gained from a third party without breach of this Agreement,
- (c) that is or became generally available to the public through no fault of Recipient,
- (d) that is independently developed by Recipient without use of the Confidential Information, or
- (e) required by a government agency.

4. Term

The obligations of Recipient herein shall be effective for *[three (3) years]* following the date of disclosure pursuant to this Agreement.

5. Ownership of Confidential Information

All Confidential Information shall remain the property of Inventor, who may use Confidential Information for any purpose without obligation to Recipient. Nothing contained herein shall be construed as granting, implying or conferring to Recipient any rights in the Confidential Information. Recipient may not assign this Agreement or any interest herein without Inventor's express prior written consent. Recipient further agrees not to disclose its participation in this undertaking, except as allowed by Inventor.

6. Equitable Relief

Recipient agrees that in the event of any breach or threatened breach, Inventor may obtain, in addition to any other legal remedies which may be available, such equitable relief as may be necessary to protect Inventor against any such breach or threatened breach.

IN WITNESS WHEREOF, the parties have executed this Agreement as of the date first above written.

_____	_____
[Print or Type Inventor's Name]	[Person Signs on Behalf of Recipient]
Date: _____	Name: _____
	Title: _____
	Date: _____

F. INFORMATION DISCLOSURE STATEMENT

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/06a (01-10)
Approved for use through 07/31/2012: OMB 0651-0031
U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	
	Filing Date	
	First Named Inventor	
	Art Unit	
	Examiner Name	
	Attorney Docket Number	

U.S. PATENTS							Remove	
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear		
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If you wish to add additional Foreign Patent Document citation information please click the Add button.							Add	
NON-PATENT LITERATURE DOCUMENTS							Remove	
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, page(s), volume-issue number(s), publisher, city and/or country where published.					T ⁵	

FIGURE A1.1.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		Application Number		
		Filing Date		
		First Named Inventor		
		Art Unit		
		Examiner Name		
		Attorney Docket Number		

	1		<input type="checkbox"/>
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If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE			
Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

FIGURE A1.2.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		
	Filing Date		
	First Named Inventor		
	Art Unit		
	Examiner Name		
	Attorney Docket Number		

CERTIFICATION STATEMENT			
Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):			
<input type="checkbox"/> That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).			
OR			
<input type="checkbox"/> That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).			
<input type="checkbox"/> See attached certification statement.			
<input type="checkbox"/> The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.			
<input type="checkbox"/> A certification statement is not submitted herewith.			
SIGNATURE			
A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.			
Signature		Date (YYYY-MM-DD)	
Name/Print		Registration Number	
<p>This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.</p>			

FIGURE A1.3.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

FIGURE A1.4.

G. INVENTOR'S OATH

This declaration is directed to the attached application, Application No. [application number] filed on [date of filing].

As the inventor, I declare that:

I believe I am the original and first inventor of the subject matter claimed in the patent I am seeking.

I have reviewed and understand the contents of the application listed above, including the claims.

I acknowledge the duty to disclose all information known to me to be material to patentability to the United States Patent and Trademark Office, including information in continuation-in-part applications and any material information which becomes known to me between the date of filing and any future national or international filing date or continuation-in-part.

All statements made in this oath are true to the best of my knowledge and I believe all information in this application to be true.

I know that willful false statements made in connection with this application could be punishable under Section 1001 of Title 18 by a fine, imprisonment of not more than 5 years, or both, and may jeopardize the validity of my application and any ensuing patent.

Inventor: [inventor's printed name]

Address: [inventor's full address]

Citizen of: [inventor's country of citizenship]

Signature: _____

H. PATENT LICENSE AGREEMENT

This Agreement is made and entered into this *[date]* day of *[month]*, *[year]*, (the “Effective Date”) by and between *[owner of patent/invention]*, having its principal office at *[address]* (the “Patent Owner”), and *[company licensing patent]*, having its principal office at *[address]* (the “Licensee”).

WHEREAS, Patent Owner is the owner of certain Patent Rights (as later defined herein) relating to *[technology covered by patent]* by *[inventor’s name]* and has the right to grant licenses under said Patent Rights;

WHEREAS, Patent Owner desires to have the Patent Rights developed and commercialized to benefit the public and is willing to grant a license thereunder;

WHEREAS, Licensee has represented to Patent Owner that Licensee is experienced in the development, production, manufacture, marketing, and sale of products similar to the Licensed Product (as later defined herein) and/or the use of the Licensed Process (as later defined herein) and that it shall commit itself to a thorough, vigorous, and diligent program of exploiting the Patent Rights so that public utilization shall result therefrom; and

WHEREAS, Licensee desires to obtain a license under the Patent Rights upon the terms and conditions hereinafter set forth.

NOW, THEREFORE, in consideration of the promises and the mutual covenants contained herein, the parties hereto agree as follows:

Article 1: Definitions

For the purposes of this Agreement, the following words and phrases shall have the following meanings:

- 1.1 “Patent Rights” shall mean all of the following Patent Owner intellectual property:
 - (a) the United States and foreign patents and/or patent applications listed in the Appendix;
 - (b) United States and foreign patents issued from the applications listed in the Appendix and from divisionals and continuations of these applications;
 - (c) claims of U.S. and foreign continuation-in-part applications, and of the resulting patents, which are directed to subject matter specifically described in the U.S. and foreign applications listed in the Appendix;

- (d) claims of all foreign patent applications, and of the resulting patents, which are directed to subject matter specifically described in the United States patents and/or patent applications described in (a), (b), or (c) above; and
 - (e) any reissues of United States patents described in (a), (b), or (c) above.
- 1.2 A “Licensed Product” shall mean any product or part thereof which:
- (a) is covered in whole or in part by an issued, unexpired claim or a pending claim contained in the Patent Rights in the country in which any such product or part thereof is made, used or sold; or
 - (b) is manufactured by using a process or is employed to practice a process which is covered in whole or in part by an issued, unexpired claim or a pending claim contained in the Patent Rights in the country in which any Licensed Process (as defined below) is used or in which such product or part thereof is used or sold.
- 1.3 A “Licensed Process” shall mean any process, which is covered in whole or in part by an issued, unexpired claim or a pending claim contained in the Patent Rights.
- 1.4 “Territory” shall mean *[geographic area license will cover, such as a state, country or region]*.
- 1.5 “Field of Use” shall mean *[industries or fields in which invention can be commercialized, such as health care or information technology]*.

Article 2: Grant of License

- 2.1 Patent Owner hereby grants to Licensee the right and license to make, have made, use, lease, sell and import the Licensed Products and to practice the Licensed Processes in the Territory for the Field of Use.
- 2.2 In order to establish a period of exclusivity for Licensee, Patent Owner hereby agrees that it shall not grant any other license to make, have made, use, lease and sell Licensed Products, or to utilize Licensed Processes, in the Territory for the Field of Use during the period of time commencing with the Effective Date of this Agreement and terminating with the expiration of *[five years after the first commercial sale of a Licensed Product or first commercial use of a Licensed Process]*. At the end of the exclusive period, the license granted hereunder shall become nonexclusive.
- 2.3 Patent Owner reserves the right to practice under the Patent Rights for its own purposes, including the right to provide noncommercial use of Patent Rights to third parties for their own noncommercial research and academic purposes.

- 2.4 Licensee shall have the right to sublicensing the rights, privileges and licenses it has under this Agreement. Licensee agrees to forward to Patent Owner a copy of all sublicense agreements promptly upon execution.

Article 3: Diligence and Performance Milestones

- 3.1 Licensee shall use its best efforts to bring one or more Licensed Products or Licensed Processes to market through a thorough, vigorous and diligent program for exploitation of the Patent Rights and to continue active, diligent marketing efforts for one or more Licensed Products or Licensed Processes throughout the life of this Agreement.
- 3.4 Licensee shall adhere to the following milestones: *[list performance milestones, such as revenue earned, royalties paid, investment capital attracted or research completed]*. Licensee's failure to meet performance milestones shall be grounds for Patent Owner to terminate this Agreement.

Article 4: Royalties

Licensee shall pay royalties to Patent Owner in the manner hereinafter provided to the end of the term of the Patent Rights or until this Agreement shall be terminated:

- 4.1 A nonrefundable License Issue Fee *[\$5,000]*, which shall be due on the Effective Date of this Agreement.
- 4.2 A nonrefundable License Fee *[\$50,000]*, which shall be due immediately upon written notice of successful *[sale, clinical trial or other metric suggesting success]* of a product incorporating one or more Licensed Products or made using one or more Licensed Processes.
- 4.3 A nonrefundable fee the greater of *[\$10,000]* or *[5 percent]* of any lump sum consideration received by Licensee from a sublicensee, which shall be due immediately upon execution of a sublicense.
- 4.4 Running Royalties in an amount equal to *[5 percent]* of gross sales of the Licensed Product and Licensed Process used, leased or sold by Licensee and its sublicensees.

Article 5: Reports and Records

Licensee shall keep full, true, and accurate books of account containing all particulars that may be necessary for the purpose of showing the amounts

payable to Patent Owner hereunder. Said books shall be made available for the Patent Owner's inspection upon request. Furthermore, beginning in *[year three of this license]*, the Licensee shall submit quarterly reports of the following information to the Patent Owner: *[number of Licensed Products manufactured, total billings for all Licensed Products sold by Licensee, royalties due from sublicensees and total royalties due]*.

Article 6: Patent Prosecution

- 6.1 Patent Owner shall apply for, seek prompt issuance of, and maintain during the term of this Agreement the Patent Rights in the United States and in the foreign countries listed in the Appendix. The prosecution, filing, and maintenance of all Patent Rights patents and applications shall be the primary responsibility of Patent Owner; however, Licensee shall have reasonable opportunities to advise Patent Owner and shall cooperate with Patent Owner in such prosecution, filing, and maintenance.
- 6.2 Licensee is responsible for costs incurred in patent prosecution, filing, and maintenance. Licensee may at any time upon written notice to Patent Owner elect not to be responsible for any future patent costs incurred by Patent Owner. If Licensee makes any such election not to incur any future patent costs, the license shall terminate as to any patent rights for which Licensee has elected not to be responsible.

Article 7: Infringement

- 7.1 Licensee shall inform Patent Owner promptly in writing of any alleged infringement of the Patent Rights by a third party.
- 7.2 During the term of this Agreement, Patent Owner shall have the right, but shall not be obligated, to prosecute at its own expense all infringements of the Patent Rights. If the total cost of the infringement action falls to Patent Owner, Patent Owner shall keep any recovery or damages.
- 7.3 If infringement persists *[six months after notification]* or if Patent Owner notifies Licensee of its intention not to bring suit, then, and in those events only, Licensee shall have the right, but shall not be obligated, to prosecute at its own expense any infringement of the Patent Rights in the Territory for the Field of Use. No settlement or other voluntary final disposition of the suit may be entered into without the consent of

Patent Owner. If the total cost of the infringement suit falls to Licensee, Licensee may withhold up to 50 percent of the recovery or damages payments to cover up to half of the Licensee's legal fees.

- 7.4 In any infringement suit, the parties to this Agreement shall, at the request and expense of the party initiating such suit, cooperate in all respects. To the extent possible, the party shall have its employees testify when requested and make available relevant records, papers, information, samples, specimens, and the like.

Article 8: Product Liability

- 8.1 Licensee shall at all times during the term of this Agreement indemnify, defend and hold Patent Owner, its trustees, directors, officers, employees and affiliates, harmless against all claims, proceedings, demands and liabilities of any kind whatsoever resulting from the production, manufacture, sale, use, lease, consumption or advertisement of the Licensed Products or Licensed Processes.
- 8.2 Licensee shall obtain and carry in full force and effect commercial, general liability insurance to protect Licensee and Patent Owner.

Article 9: Termination

- 9.1 If Licensee shall cease to carry on its business, this Agreement shall terminate upon notice by Patent Owner.
- 9.2 Should Licensee fail to make any payment whatsoever due and payable to Patent Owner hereunder, Patent Owner shall have the right to terminate this Agreement effective on *[30 days']* notice, unless Licensee shall make all such payments to Patent Owner within said *[30 days]* period.
- 9.3 Upon any material breach or default of this Agreement by Licensee (including breaches of any of the terms listed above), Patent Owner shall have the right to terminate this Agreement and the rights, privileges and license granted hereunder effective on *[90 days']* notice to Licensee. The termination will be effective *[90 days]* after notice is given, unless the Licensee cures the breach.
- 9.4 Licensee shall have the right to terminate this Agreement at anytime on *[six months']* notice to Patent Owner, and upon payment of all amounts due Patent Owner through the effective date of the termination.

IN WITNESS WHEREOF, the parties have duly executed this Agreement the day and year set forth below.

Licensor

Licensee

By _____ By _____

Name _____ Name _____

Title _____ Title _____

Date _____ Date _____

I. SPONSORED RESEARCH AGREEMENT

This Sponsored Research Agreement (“Agreement”) made and effective as of *[effective date]* (“Effective Date”) is entered into by and between *[company name]* (the “Sponsor”) with a principal place of business at *[principle place of business]* and *[university name]* (the “University”).

WHEREAS, the program contemplated by this Agreement is of mutual interest and benefit to the University and to the Sponsor, will further the instructional and research objectives of the University in a manner consistent with its status as a non-profit, tax-exempt education institution, and may derive benefits for both the Sponsor and the University through inventions, improvements, and/or discoveries;

NOW, THEREFORE, in consideration of the premises and mutual covenants herein contained, the parties hereto agree to the following:

Article 1: Definitions

- 1.1 “Sponsored Project” is the program as described in the Appendix.
- 1.2 “Principal Investigator” or “PI” is the person, designated by the University, and accepted by the Sponsor, who is directly responsible for executing, directing, overseeing and reporting such Sponsored Project under this Agreement.
- 1.3 “Intellectual Property” means and includes all technical information, inventions, trade secrets, patents, copyrights, trademarks, research, developments, discoveries, software, know-how, methods, techniques, formulae, data, processes, specimens, biological materials, software, designs, drawings, sketches and other proprietary ideas, whether or not patentable or copyrightable, developed during the Sponsored Project.
- 1.4 “University Intellectual Property” shall mean all Intellectual Property conceived and/or made solely by one or more employees of the University in performance of the Sponsored Project.
- 1.5 “Joint Intellectual Property” shall mean all Intellectual Property conceived and/or made jointly by one or more employees of the University and by one or more employees of the Sponsor in performance of the Sponsored Project.
- 1.6 “Sponsor Intellectual Property” shall mean all Intellectual Property conceived of and/or made solely by the employees of the Sponsor without the use of University facilities or equipment in performance of the Sponsored Project.

Article 2: Term

This Agreement shall be effective as of the Effective Date and shall extend for a period of *[term of project]* years (the “Term”), unless terminated earlier by either party pursuant to Article 8 of this Agreement.

Article 3: Sponsored Project

- 3.1 The University shall commence the Sponsored Project promptly after the Effective Date of this Agreement and upon payment by the Sponsor of any funds owed, and shall use reasonable efforts to conduct such Sponsored Project in accordance with the terms and conditions of this Agreement. The Sponsor acknowledges that the University and the PI shall have the freedom to conduct and supervise the Sponsored Project in a manner consistent with the University’s research mission. This Agreement shall not be construed to limit the freedom of individuals participating in the Sponsored Project to engage in any other research.
- 3.2 During the Term of this Agreement, any changes in the direction or scope of the Sponsored Project must be in writing as an amendment to this Agreement and agreed to by mutual consent of the parties by their authorized representatives.
- 3.3 If the services of the PI become unavailable to the University for any reason, the University shall be entitled to designate another member of its faculty, who is acceptable to both parties, to serve as the PI of the Sponsored Project. This acceptance is not to be unreasonably withheld. If a substitute PI is not designated within *[sixty]* days after the original PI ceases his or her services under this Agreement, either party may terminate this Agreement.

Article 4: Costs

The Sponsor will pay the University \$_____ pursuant to the following cost statement: *[terms of the agreement, which could include a percentage due on signing, as well as the dates on which additional payments are due]*.

Invoices should be sent to:

Name: _____

Address: _____

Phone: _____

E-mail: _____

Checks should be sent to:

University Accounts Receivable Address

ACH/EFT Payments to:

Account Name: _____

Account # _____

Bank Address

SWIFT/BIC: _____

ABA routing number: _____

The parties estimate that this amount is sufficient to support the Sponsored Project. The University may submit to the Sponsor a revised budget requesting additional funds if the Sponsor requests a change in the Sponsored Project. The Sponsor will not be liable for any payment in excess of the fixed price amount except upon the Sponsor's written agreement.

Article 5: Publications

Notwithstanding anything to the contrary, the Sponsor recognizes that the results of the Sponsored Project must be publishable and agrees that researchers engaged in the Sponsored Project shall be permitted to present at symposia, national, or regional professional meetings, and to publish in journals, theses or dissertations, or otherwise of their own choosing, methods and results of the Sponsored Project. However, the researchers shall furnish the Sponsor copies of any proposed publication or presentation at least _____ days in advance of the submission of such proposed publication or presentation to a journal, editor, or other third party. In the event that the Sponsor makes an objection to publication, the University shall refrain from making such publication or presentation for a maximum of _____ days from the date of receipt of such objection in order for University to file patent applications directed to the patentable subject matter contained in the proposed publication or presentation.

Article 6: Intellectual Property

- 6.1 All rights and title to University Intellectual Property shall belong to the University. Sponsor Intellectual Property shall belong to the Sponsor.

Joint Intellectual Property shall belong jointly to the University and the Sponsor.

- 6.2 The University will notify the Sponsor of any University Intellectual Property or Joint Intellectual Property conceived and/or made during the term of the Sponsored Project. If the Sponsor directs that a patent application or application for other intellectual property protection be filed, the University shall promptly prepare, file and prosecute such U.S. and foreign applications in the University's name if for University Intellectual Property, and in both the University's and the Sponsor's names if for Joint Intellectual Property. The Sponsor shall bear all costs incurred in connection with such preparation, filing, prosecution, and maintenance of U.S. and foreign applications. While the University shall be responsible for making decisions regarding scope and content of applications to be filed and prosecution thereof, the Sponsor shall be given an opportunity to review and provide input thereto.
- 6.3 If the Sponsor elects not to seek protection pursuant to Article 6.2, or decides to discontinue the financial support of the prosecution or maintenance of the protection, or elects not to exercise its option pursuant to Article 7, the University shall be free to file or continue prosecution or maintain any such applications, and to maintain any protection issuing thereon at the University's sole expense and for its own purposes.

Article 7: Grant of Rights

- 7.1 In consideration of the Sponsor's participation as a sponsor of the project, the University shall grant to the Sponsor a first option to negotiate to acquire a royalty-bearing license to practice University Intellectual Property and/or Joint Intellectual Property and to make, have made, use, and sell products using or incorporating University Intellectual Property and/or Joint Intellectual Property. However, the University will retain the right to make and use University Intellectual Property and/or Joint Intellectual Property for educational and research purposes only.
- 7.2 The University and the Sponsor will negotiate in good faith to determine the terms of a license agreement. If the University and the Sponsor fail to execute a license agreement within *[usually three to six months]* following the first disclosure of University Intellectual Property and/or Joint Intellectual Property to the Sponsor, then the University shall be free to license University Intellectual Property and/or Joint Intellectual Property to any party upon such terms as the University deems appropriate.

Article 8: Termination

- 8.1 This Agreement shall terminate at the end of the Term or *[usually 60 to 90 days]* from written notice of one party to the other.
- 8.2 In the event that a party hereto commits any breach of any of the terms or conditions of this Agreement, and also fails to remedy such breach within *[30 days]* after receipt of any notice of the breach from another party hereto, the party giving notice may terminate this Agreement by sending notice of termination in writing to the other party and such termination shall be effective as of the date of the receipt of such notice.
- 8.3 Termination of this Agreement by a party for any reason shall not affect the rights and obligations of the parties accrued prior to the effective date of termination of this Agreement. Notwithstanding the foregoing, Sponsor's rights under Article 7 to have the first option to license University Intellectual Property and/or Joint Intellectual Property shall terminate upon early termination of this Agreement requested by the Sponsor or as a result of the Sponsor's breach of this Agreement.
- 8.4 In the event of early termination of this Agreement by the Sponsor, the Sponsor shall pay all costs accrued by the University as of the date of termination, including non-cancelable obligations, which shall include all non-cancelable contracts and fellowships or post-doctoral associate appointments issued pursuant to the Sponsored Project, incurred prior to the effective date of termination.

Article 9: Disclaimer of Warranties; Indemnification

- 9.1 The University makes no warranties, express or implied, as to any matter whatsoever, including without limitation, warranties with respect to the conduct, completion, success or particular results of the Sponsored Project, or the condition of any inventions or products conceived, discovered, or developed under this Agreement or that any invention developed hereunder shall be free of infringement or third-party intellectual property rights. The University shall not be liable for any damages suffered by the Sponsor or any other person resulting from the Sponsored Project.
- 9.2 The Sponsor agrees to defend, indemnify, and hold harmless the University, the PI, and any University faculty, students, volunteers, employees, trustees, officers, affiliates, and agents from and against any and all liability, claims, lawsuits, losses, damages, costs, or expenses, which may be incurred as a result of the Sponsor's use of the results of the Sponsored Project or as a result of any breach of this Agreement by the Sponsor.

Article 10: General Provisions

- 10.1 The interpretation and validity of this Agreement and the rights of the parties shall be governed by the laws of the State of _____. Any action brought to enforce this Agreement shall be brought in the State of _____.
- 10.2 In the event of any conflict in terms between documents relating to this Agreement, exhibits attached hereto, or grants hereunder, the terms of this Agreement will govern, except to the extent that such other document expressly contemplates superseding the terms of this Agreement and such other document is executed by authorized representatives of both parties.
- 10.3 The Sponsor will not use the name of the University, nor of any member of the University's staff, in any publicity, advertising, or news release without the prior written approval of an authorized representative of the University. The University will not use the name of the Sponsor, nor any employee of the Sponsor, in any publicity without the prior written approval of the Sponsor; provided, however, the University may make available to the public the title and description of the project, the name of the Principal Investigator, and the amount and source of funding provided for such project.
- 10.4 In the event that Sponsor is a party to any other agreement with University, a default by Sponsor of this or any other agreement shall be deemed a default under all other agreements with University.
- 10.5 Neither party may assign this Agreement without the prior written consent of the other party.
- 10.6 Any notices required to be given or which shall be given under this Agreement shall be in writing and delivered by first-class mail, facsimile transmission, or email addressed to the parties as follows:

Administrative for University

[University Name]
[University Address]
[University Phone]
[University Email]

Administrative for Sponsor

[Sponsor Name]
[Sponsor Address]
[Sponsor Phone]
[Sponsor Email]

Technical For University

[Principal Investigator]
[Investigator Address]
[Investigator Phone]
[Investigator Email]

Technical For Sponsor

[Sponsor Principal Investigator]
[Sponsor Address]
[Sponsor Phone]
[Sponsor Email]

IN WITNESS WHEREOF, the parties have caused these presents to be executed as of the Effective Date.

University

By_____

Name_____

Title_____

Date_____

Sponsor

By_____

Name_____

Title_____

Date_____

J. JOINT OWNERSHIP AGREEMENT

This Agreement (the “Agreement”) is between Company A, a *[state]* corporation having a principle place of business at *[address]*, and Company B, a *[state]* corporation having a principle place of business at *[address]*.

WHEREAS, *[name of Company A inventor]* (“Inventor A”) at the time of conception of the Invention (as defined below) was an employee of Company A;

WHEREAS, *[name of Company B inventor]* (“Inventor B”) at the time of conception of the Invention (as defined below) was an employee of Company B;

WHEREAS, in the course of research programs at Company A and Company B, Inventor A and Inventor B (collectively, the “Joint Inventors”) jointly made or reduced to practice the Invention which is included within the Patent Rights (as defined below);

WHEREAS, Company A and Company B (hereinafter, a “Party” or the “Parties”) have separate agreements with the Joint Inventors whereby the Joint Inventors agree to assign all right, title and interest in an invention to their respective institutions, and whereby the Joint Inventors agree to cooperate with and assist their respective institutions in preparing, filing, prosecuting and maintaining patent applications and patents relating to the Invention throughout the world;

WHEREAS, the Parties desire to jointly own and jointly exploit the Invention, all know-how and information relating to the Invention, and Patent Rights;

NOW, THEREFORE, in consideration of the mutual covenants and premises herein contained, the Parties agree as follows:

Section 1: Definitions

- 1.1 The “Effective Date” means this *[date]* day of *[month]*, *[year]*.
- 1.2 “Invention” means the Parties’ respective rights in products or processes invented by the Joint Inventors, further described in the Appendix.
- 1.3 “Licensing Revenue” means the actual royalties, fees, payments, equity securities and other sums received in consideration of licenses or other rights granted to, or things of value delivered to, third parties in connection with the Invention and/or Patent Rights.

- 1.4 “Patent Expenses” means all out-of-pocket expenses, as evidenced by actual invoices, incurred in searching, preparing, filing, prosecuting, and maintaining Invention and/or Patent Rights.
- 1.5 “Patent Rights” means the Parties’ respective rights in information or discoveries covered in patents and/or patent applications, whether domestic or foreign, which name all Joint Inventors as inventors and which relate to the Invention.

Section 2: Warranty of Rights

- 2.1 Except for the rights, if any, of the U.S. government, as set forth below, the Parties, to the best of their knowledge, are under no obligation to anyone other than the Joint Inventors with respect to the Invention and Patent Rights.
- 2.2 The Invention may have been developed under a funding agreement with the U.S. government and, if so, the government may have certain rights relative thereto. This Agreement and any licenses of the Invention or Patent Rights are made subject to the U.S. government’s rights under any applicable law or regulation.

Section 3: Patent Prosecution and Protection

- 3.1 The Parties will be joint and equal owners of the Invention and Patent Rights.
- 3.2 The Parties will each use their best efforts to assure that the Joint Inventors fully cooperate in the preparation, filing, prosecution and maintenance of Patent Rights.
- 3.3 The Parties will jointly select and approve a patent attorney. Company A is responsible for preparing, filing, prosecuting and maintaining Patent Rights and will consult with and keep Company B fully informed as to the status of Patent Rights. Patent Rights will be made in the name of both Parties.
- 3.4 Prosecution or maintenance of any patent and/or patent applications included in Patent Rights can only be abandoned with the written consent of both Company A and Company B.
- 3.5 Either Party may, upon reasonable written notice to the other Party, discontinue paying the Patent Expenses associated with any particular patent application or patent. If a Party decides to discontinue paying the Patent Expenses and the other Party continues to pay such expenses, the paying Party will own all rights, title, and interest in and to that patent application or patent.

Section 4: Licensing

The Parties will cooperate to commercialize, utilize, and exploit the Invention and Patent Rights and will keep each other informed of all requests to license by third parties. Notwithstanding the above, neither Party has any right to commercialize, utilize, exploit, or license the Invention or Patent Rights without the express written permission of the other Party, which will not be unreasonably withheld. All licenses with respect to the Invention or Patent Rights will be made jointly in the name of and executed by both Parties and will be administered by Company A.

Section 5: Expenses, Payments and Reports

- 5.1 The Parties will share Patent Expenses. Company A will be responsible for paying ___% of Patent Expenses, and Company B will be responsible for paying ___% of Patent Expenses.
- 5.2 Both Parties recognize that the other Party may incur certain legal expenses regarding the Invention or Patent Rights related to matters pertaining solely to the other institution. In such circumstances, these expenses will not be considered Patent Expenses.
- 5.3 Company A will maintain adequate records showing all Patent Expenses incurred, which will be made available to Company B for inspection on reasonable notice. When possible, Company A will notify and obtain Company B's approval prior to incurring Patent Expenses. In the event that notification is not provided prior to certain Patent Expenses being incurred, Company B will have the right to decline to pay for expenses that, in Company B's reasonable business judgment, were not incurred in a prudent manner or were not necessary in order to achieve the purposes of this Agreement.
- 5.4 Within 45 days of the receipt of bills for any Patent Expenses, Company A will provide Company B with an invoice for Patent Expenses giving an accounting of the amount of Patent Expenses incurred, the purpose of such Patent Expenses and the amount of Patent Expenses owed by Company B. Company B will reimburse Company B within 45 days of receiving the invoice.
- 5.5 Licensing Revenue will be shared by the Parties. If one of the Parties discontinues paying Patent Expenses for any patent or patent application, then such Party will not receive any additional proceeds from Licensing Revenue attributable to such patent or patent application other than the reimbursement of contributed Patent Expenses. Any Licensing Revenue will be first applied to any unreimbursed Patent Expenses

incurred by Company B. After approval of necessary reimbursement of Patent Expenses, Company A and Company B may mutually agree to hold all or a portion of any remaining Licensing Revenue in anticipation of future unreimbursed Patent Expenses. In the event Company A and Company B designate Licensing Revenue for disbursement, ___% of such Licensing Revenue will be disbursed to Company A and ___% of such Licensing Revenue will be disbursed to Company B.

- 5.6 Within 45 days of the receipt of Licensing Revenue from any licensee, Company A will provide Company B with a written report giving an accounting of the total amount of Licensing Revenue received, the amount of Licensing Revenue to be applied to reimbursement of Patent Expenses, the amount of Licensing Revenue to be held in anticipation of future unreimbursed Patent Expenses, the amount of Licensing Revenue retained by Company and the amount of Licensing Revenue due to Company B. Simultaneously with the delivery of such report, Company A must pay Company B the amount due.
- 5.7 Company B will have the right to cause an independent, certified public accountant reasonably acceptable to Company A to audit financial records relating to Licensing Revenue and Patent Expenses. Such audits may be exercised during normal business hours upon at least *[30 days]* prior written notice to Company A.
- 5.8 Each Party will be solely responsible for calculating and distributing to its respective Joint Inventors their share, if any, of the Licensing Revenue.

Section 6: Term and Termination

- 6.1 The term of this Agreement is from the Effective Date to the expiration date of the last expiring Patent Rights obtained under this Agreement, or the date of termination of the last license agreement for the Invention and Patent Rights, whichever is longer.
- 6.2 Either Party may terminate this Agreement for any reason upon *[60 days]* written notice to the other Party.
- 6.3 Nothing herein will be construed to release either Party of any obligation matured prior to the effective date of termination.

Section 7: Infringement

- 7.1 When either Party becomes aware of a potential infringement of any Patent Rights, then that Party will notify the other Party as soon as

possible and the Parties agree to discuss and determine how best to end such infringement.

- 7.2 If the Parties agree to begin an action for patent infringement, the Parties agree that the reasonable expenses and disbursements paid in connection with such action will be considered Patent Expenses and all monies actually received as a result of the patent infringement action will be considered Licensing Revenue. If the Parties cannot agree to commence an action for patent infringement, either Party will have the right to prosecute a patent infringement action, and that Party will bear all the expense and be entitled to retain all monies received as a result of such action.
- 7.3 The Parties will each use their best efforts to assure that Joint Inventors cooperate with and supply all assistance reasonably requested in connection with any patent infringement action.
- 7.4 If during a patent infringement action either Party decides to discontinue participating in the action, then the continuing Party may pay all expenses associated with such action and retain all recoveries from such action after reimbursing any infringement action related expenses incurred by the discontinuing Party at a rate equal to the percentage of total expenses contributed by the discontinuing Party.

Section 8: Confidential Information

- 8.1 Subject to the rights of publication set forth below, Company A, Company B, and the Joint Inventors will retain in confidence and will not disclose to a third party without the written consent of the other Party:
 - (i) the Invention,
 - (ii) know-how possessed by the Joint Inventors relating to the Invention,
 - (iii) all information in documents marked “confidential” forwarded to one Party by the other,
 - (iv) all biological materials related to the Invention, and
 - (v) any patent application included in the Patent Rights.

Each Party’s obligation of confidence will be fulfilled by using at least same degree of care with the other Party’s confidential information it uses to protect its own confidential information. This obligation will exist while this Agreement is in force and for a period of *[3 years]* thereafter.

- 8.2 Company A and Company B will be free to
 - (i) publish information relating to the Invention or Patent Rights in scientific journals,

- (ii) use the Invention or Patent Rights in research, teaching and other educationally related purposes, and
- (iii) maintain the Invention and make it available to the nonprofit research community solely for non-commercial research, teaching, and other educationally related purposes.

In furtherance of that publication right, Company A and Company B agree to supply the other with a copy of any manuscript prior to its submission for publication, to permit the other to evaluate such manuscripts in order to determine whether it contains patentable subject matter relating to the Invention or Patent Rights. Within *[30 days]* after receipt of a manuscript intended for publication, the receiving party will notify the submitting party whether or not a patent application will be filed in accordance with the terms and conditions of this Agreement. At the request of the receiving party, the submitting party must agree to delay publication in order to enable the preparation and filing of a patent application on any patentable subject matter described in the manuscript.

- 8.3 Nothing herein contained will preclude Company A or Company B from making reports or disclosures as required by any organizations which provided funding that resulted in the creation of all or a part of the Invention or Patent Rights.

IN WITNESS WHEREOF, the Parties hereto have caused their duly authorized representatives to execute this Agreement.

Company A

By _____

Name _____

Title _____

Date _____

Company B

By _____

Name _____

Title _____

Date _____

APPENDIX 2

SELF-ASSESSMENT QUESTIONS

The following self-assessment questions were invented (no pun intended) to help you absorb the subject matter. Try to answer them.

Some of these questions were once real-life exam questions (quizzes, mid-term and final examinations) given to graduate students who took the course “The Professional Scientist and Engineer in Industry” given many times at The University of Akron.

To make it easier for you, the questions are grouped by the chapters in this book.

No cheating!

CHAPTER 1. THE U.S. PATENT SYSTEM

1. How does the U.S. Patent Office define the word “patent”?
2. Are U.S. patents effective outside of U.S. borders?
3. What four major activities can a patent holder exclude others from doing?
4. In the patent system, what do inventors offer in exchange for the 20-year period of exclusivity granted to patent holders?
5. Give an example of an intangible asset.

How to Invent and Protect Your Invention: A Guide to Patents for Scientists and Engineers, First Edition. Joseph P. Kennedy and Wayne H. Watkins with Elyse N. Ball.
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6. Give two examples of tangible assets.
7. How do tangible and intangible assets differ?
8. What do we mean when we say that the goal of U.S. patent law is “purely utilitarian”?
9. What is the difference between a patent and an invention?
10. Why might a potentially valuable invention turn out to be a worthless patent?
11. What training does a patent attorney typically have?
12. Why do many inventors have difficulty communicating with patent attorneys?
13. If the goal of the specification is to teach, what is the goal of the claims?
14. Why do we say that a patent is a negative right?
15. What legal obstacles might prevent a patent holder from making, using, selling, or importing his patented invention?
16. What rights do patent holder have against infringers?
17. What happens if someone is found to have infringed a patent?
18. Give at least three reasons for filing a patent.
19. How does having a patent help an inventor make money from his invention?
20. How can a filing patent application help a patent holder learn about his competitors?

CHAPTER 2. ORIGINS OF U.S. PATENT LAW

1. What is the meaning (translation) of the Latin word “patent”?
2. Which medieval European city-state may be considered the cradle of the patent system? What fundamental fact did their law recognize that became the basis of modern patent systems?
3. What fundamental limitation did the 1624 British “Statutes of Monopolies” introduce for the first time?
4. The first U.S. patent law was enacted in 1790. Who signed this law?
5. Who was responsible for examining the validity of the first U.S. patents?
6. Name the document that is the source of the U.S. patent system?
7. Which government body promulgates patent law?
8. What are the two overriding purposes of the U.S. patent system?
9. Which president signed the Leahy–Smith America Invents Act into law?
10. What is a first-to-invent patent system?

11. What is a first-inventor-to-file patent system? When and why did the United States switch to this system?
12. Give at least one argument against the assertion that a patent is a government-sanctioned monopoly.

CHAPTER 3. INTELLECTUAL ASPECTS OF INVENTING

Because this chapter contains mostly personal perspectives and conclusions of one of the authors and not facts associated with the patenting process, it is not deemed an appropriate source of self-assessment questions.

CHAPTER 4. A SHORT SUMMARY OF INTELLECTUAL PROPERTY

1. Name the four major types of intellectual property.
2. Name the three major types of patent. Which type of patent is the focus of this book?
3. Name the two legal requirements of a trade secret.
4. How can you disclose a trade secret to another person or company?
5. What factors would you look for before deciding to protect an invention as a trade secret?
6. Give examples of two things that are protected as trade secrets.
7. Name as many major categories of copyright as you can.
8. What does copyright law protect and what does copyright law not protect?
9. Give examples of at least three things that can be protected by copyright.
10. What two forms of intellectual property can be used to protect computer software?
11. After a lot of work, you have assembled a list of names and addresses of scientists living in California. The list will be sold to a distributor who will mail promotional matter to them. Can you protect your list by copyright?
12. When does copyright protection commence?
13. How long does a registered copyright generally last?
14. What does the “fair use exception” to copyright allow?
15. What is a trademark?
16. What is a servicemark?
17. What is the purpose of trademark law?

18. Give examples of two things that are protected as trademarks.
19. How long does a trademark last?
20. Name at least two types of intellectual property other than patents, trade secrets, copyrights, and trademarks. In what situations do these other types of intellectual property apply?

CHAPTER 5. REQUIREMENTS FOR PATENTABILITY

1. What basically is a patent?
2. What is the term (effective life) of a U.S. patent? And when does the term of a patent start?
3. What right does a patent confer on the inventor?
4. What is a composition of matter?
5. The PTO granted you a composition of matter patent for a new inexpensive but valuable chemical. Can you start to make and sell your chemical?
6. Is a patent a defensive or offensive weapon? Elaborate.
7. List the things that can be patented under Section 101 of U.S. Code Title 35.
8. Give examples of things that cannot be patented.
9. During your Ph.D. research, you prepared various gas separation membranes and carried out many diffusion experiments with them. Suddenly you discover a new relationship:

$$P = S \times D$$

where P is permeability, S is gas solubility, and D is the diffusion coefficient of the gas. You prepare a manuscript for publication, however, before submitting it to a journal you file for patent protection. What will be the reaction of the patent examiner?

10. State the “First Law of Inventing” and define its components.
11. Name the requirements that must coexist for patentability.
12. State the requirements of “novelty” as per Section 102.
13. What is the “one-year rule”?
14. An engineer invents a novel kitchen gadget and explains the invention to his family and friends. He builds the gadget and uses it for six months in his kitchen and demonstrates its use to his friends and visitors. They are all impressed. Subsequently he applies for patent protection of the gadget. Will the engineer’s patent application be allowed or rejected?

15. The above engineer used his invention at least once each day to test its durability, made careful notes on the results, and took pictures to document the process.

What rule could he assert to make the examiner more likely to grant his patent?

16. What process does the examiner start if two (or more) inventors happen to file patent applications on the same invention at about the same time? And what is the objective of this process?
17. What is the antithesis of “novelty”?
18. Can an inventor create a statutory bar to her own invention?
19. Is the patent examiner concerned about infringement? If not, what is the examiner concerned about?
20. Define “prior art.”
21. A botanist on an expedition to Alaska discovers a rare plant in the tundra used by the Eskimos for medicinal purposes. He identifies the active ingredient in the juices of the plant and proves it effective against gout. Then he applies for patent protection on the plant. Will his patent application be approved or rejected? Elaborate.
22. You filed a utility patent application in 2010 for a new composition of matter. The examiner rejected your application and cites a 1979 (expired) patent and a 1999 (still valid) patent as prior art. You decide to fight the rejection and start to analyze the patents. Which of the two patents will be more dangerous to you, the old one or the new one?
23. Define “unobviousness.”
24. Bob comes up with a way to make vanilla-flavored coffee. He experiments and finds that 5 mg of vanilla extract per gram of ground coffee gives a pleasantly flavored brew. Bob applies for a patent on this. What will be the examiner’s opinion?
25. What does a “person having ordinary skill in the art” know in regard to prior art?
26. You discover and react new chemicals and obtain a new composition of matter by using a known process. You file for a patent and claim (i) your new composition of matter and (ii) the process of making it. Which claims will the examiner allow?
27. What characteristics must an invention have to become unobvious in respect to similar prior art?
28. You think you made an invention and file a patent application. The patent examiner rejects your key claim and cites two prior references, which in combination anticipate your claim. What must you do (what facts must you present) to convince the examiner to allow your claim?

29. During a visit to your dentist you notice an unusual oral surgery knife. You suddenly conceive that this device could be used as a gardening tool to graft roses. You purchase such a knife on the open market and you discover that the knife indeed works well for grafting roses. Can you get protection on the gardening tool? If not, why not? If yes, what claims can you get?
30. An invention must be unobvious (in addition of being useful and novel). Illustrate with a brief example why utility and novelty alone (absent of unobviousness) are insufficient and would not promote science and technology.
31. You invented a new kind of trumpet and the method for its manufacture. To test your trumpet, you lend it to your musician friend who uses it in public in his orchestra. After ~18 months you both examine the trumpet and find it in excellent condition. You sell the trumpet to your friend way below cost because he helped to test it, then you file a patent application claiming (i) the new trumpet and (ii) the method for making the new trumpet. What will the patent examiner's reaction be in regard to your two claims?
32. You own a pet animal shop and one day you accidentally discover that a common cold remedy (Tylenol) fed to your sick pigeons makes them sing like canaries.

Can this observation become the basis of a patent? If so, what kind of patent will you apply for?
33. What is the teaching of the seminal aspirin patent?
34. Name secondary considerations that may demonstrate unobviousness.
35. State the "Second Law of Inventing" and define its components.
36. In one sentence each, define the two types of reduction to practice.
37. What is a prophetic patent? And when is such a patent particularly useful?
38. State the three major parts of a modern U.S. patent.
39. Name as many pieces of information as you can that appear on the cover sheet of a patent.
40. What two requirements must the specification meet?
41. What is the key function of the specification?
42. A specification and technical publication are similar in many respects but are fundamentally different in purpose. Comment on this difference.
43. What is meant by "best mode"?
44. What is a claim?
45. Name the types of claims. How do they differ?

46. Comment on the relationship between the specification and claims.
47. Charlie discovers an electron beam crosslinking process to toughen polyethylene. He then applies this crosslinked polyethylene to produce superior air-conditioning tubing. Subsequently he files for patent protection on the crosslinked polyethylene tubing. The examiner, however, identifies a patent that discloses a polyethylene crosslinked by electron beams used as medical tubing. Name of the doctrine that prevents Charlie from getting his claim allowed.
48. Which technologies (art forms) did the Supreme Court name “predictable arts” and “unpredictable arts”?
49. The knowledge of the “one-year rule” is particularly important for university researchers. Elaborate why.
50. PHOSITA is an abbreviation for a hypothetical al person of crucial importance for U.S. patent law. What does PHOSITA stand for and what are the characteristics of this person?

CHAPTER 6. HOW DOES THE PATENT PROCESS WORK?

1. How does the PTO assist the inventor in developing his invention?
2. Why is a signed, dated, and witnessed notebook entry useful?
3. Who cannot be a notebook witness for your invention?
4. What is the main purpose of the provisional patent application?
5. What is the fate of the provisional patent application in the PTO?
6. When is the provisional patent application published?
7. How is a provisional patent application constructed? And what parts may a provisional application not contain that are essential for a non-provisional or regular patent application?
8. What important advantages does a provisional patent application provide, particularly for an academic inventor?
9. You made a patentable discovery during your lengthy Ph.D. research and filed more than one provisional patent application. Can you later combine these to render your invention stronger?
10. When are you allowed to advertise the product of your invention as “patent pending”?
11. How must a regular (or nonprovisional) patent application be written?
12. Name the parts of a nonprovisional patent application.
13. In addition to Patent Law (U.S. Code 35), what two key documents must be followed in preparing a regular patent application?

14. Both patent attorneys and patent agents can help you prepare a patent application and deal with the PTO. What is the main difference between these two professionals?
15. What does a patent professional do for you in order to file a patent application?
16. At what point in time is the nonprovisional patent application published?
17. How can you prevent the publication of your regular patent application?
18. After your patent application is published, someone (say, one of your competitors) may cite prior art against it. What may be the consequence of this?
19. What is “prosecution” of a patent application? What is the purpose of this process?
20. How does the commercialization potential of an invention affect prosecution?
21. To what extent is the patent examiner in charge of your patent application interested in evaluating infringement?
22. What is the “first office action”?
23. What is “accelerated examination”?
24. What constitutes the first phase of the examination process?
25. Complete the sentence: The first office action is typically . . .
26. What is a Section 102 rejection?
27. What is a Section 103 rejection?
28. What does “restriction” mean and what must an inventor do in response?
29. What is the meaning of the frequently used expression “read on”?
30. A “final rejection” is seldom final. What action can an inventor undertake to overcome it?
31. When is a “continuation application” and what is its purpose?
32. What is meant by “duty of candor”?
33. What is meant by “inequitable conduct”?
34. What is a continuation-in-part?
35. Why is a continuation-in-part important for an active scientist or engineer?
36. What is the priority date of a continuation-in-part application?
37. What can the inventor do when he makes additional improvements in the invention while the continuation-in-part is being examined?
38. What is a divisional application and when is it used?
39. Contrast continuation, continuation-in-part, and divisional applications.
40. What three things most often lead to a patent being invalidated?

41. What is maintenance fee (also called an annuity)?
42. Who can initiate a post-grant review and what is the aim of this action?
43. How long after a patent is issued can a post-grant review be initiated?
44. What can the outcomes of a post-grant review be?
45. What is the difference between a post-grant review and *inter partes* review?
46. What is the purpose of a reissue application?
47. What do you need to prove to apply for a reissue application?
48. What is the main purpose of supplemental examination?
49. Can the supplemental examination process be used to change the claims of an issued patent?
50. Contrast supplemental examination with a reissue application.

CHAPTER 7. INFRINGEMENT AND FREEDOM TO OPERATE

1. What is infringement?
2. What two parts does an infringement lawsuit typically consist of?
3. Tina has invented the pancake turner, a flat device with a handle used to flip pancakes, grilled cheese, and other items cooked on a stovetop. She patents this device. Justin conceives the idea of making the pancake turner out of heat-resistant plastic, so that it lasts much longer when being used to flip hot foods. Justin also obtains a patent. What must Justin do in order to make and sell his heat resistant pancake turner? What word would we use to describe the relationship between Tina's patent and Justin's patent?
4. Suppose that in the example above, Justin abandons his inventive activities around the heat-resistant pancake turner. He conceives the idea for a device that can be used to grab pancakes or grilled cheese on the top and bottom so that they can be flipped. He obtains a patent on this technology, which falls outside the claims of Tina's patent. What must Justin do in order to make and sell his invention?
5. What is a royalty?
6. How do anticipation and domination differ? Which issue are patent examiners concerned with?
7. What is literal (or direct) infringement?
8. Contrast open claims with closed claims. Which types of claims would most inventors prefer?
9. Which phrase is used to construct an open claim: "comprises" or "consists of"?

10. What is the Doctrine of Equivalents? When does it apply?
11. What is contributory infringement and who can be guilty of it?
12. What happens if an infringer is found to have willfully infringed a patent?
13. Define “freedom to operate.”
14. Why is freedom to operate important if you know you can get a patent?
15. How do you determine if you are free to operate?
16. What is a patent troll and how do patent trolls commonly use the patents they own?
17. What event commonly forces a patent auction?
18. What is a submarine patent? Why are submarine patents less troublesome today than they were a few decades ago?
19. What qualifies as a prior commercial use?
20. If a company has been engaging in a prior commercial use, what rights do they have against a patent holder?
21. What is a personal defense?
22. Can a company that engaged in prior commercial use continue this use in all of its factories?
23. Name two of the three major exceptions that prevent a company from asserting the prior commercial use defense.
24. What happens if a company that has been making a prior commercial use stops doing so for several years?
25. You are the owner of a small company that has a valid patent for chemical X. You have not licensed the rights to anyone. One day you notice an advertisement in a magazine that Apex Co. is offering X for sale.
 - a. What is this situation called?
 - b. What action(s) will you take?
 - c. What action will the PTO take?

CHAPTER 8. BIOTECHNOLOGY, COMPUTER SOFTWARE AND BUSINESS METHODS PATENTS

1. In 1980 the Supreme Court handed down a seminal decision on the *Chakrabarty* patent application. What is the essence of this ruling?
2. In *Chakrabarty*, what three-letter word from Section 101 of the Patent Law was critical in the Supreme Court’s ruling to allow a patent on a living thing?

3. Give at least three examples of living things that have been patented.
4. An enabling specification cannot be written on biological materials (genes, microorganisms, proteins, yeasts, etc.) because they cannot be precisely described by words alone. How was this problem solved by international treaty? Elaborate.
5. What conditions must a new microorganism satisfy to make it patentable?
6. What is “OncoMouse”?
7. Can genetically engineered animals be patented? What are they considered to be? What federal agency approves their marketing?
8. Are chimera (say, part fish, part mammal) patentable? Elaborate.
9. Are genetically engineered foods (say tomatoes) patentable?
10. Can a patent issue with a claim directed to a human organism?
11. The exact molding temperature and time of a plastic toy is automatically controlled by a computer programmed by a mathematical equation (a written algorithm). Because mathematical equations or written matter are not patentable, how can the molding process be protected? Elaborate.
12. What requirements must be satisfied in order for an inventor to patent a computer program?
13. A software program has been written to calculate the base taxes that must be paid by an employee who is an independent contractor? The program does nothing more than calculates this number. Is the software program patentable?
14. A software program runs a 3D printer allowing engineers to create an object on their screen and then render a physical scale model of the invention. Is this software program patentable?
15. Why is software protectable by both patents and copyrights?
16. Why is the patenting of computer software such a difficult undertaking? Elaborate.
17. What is a business method?
18. How was Amazon able to patent its “Buy with One Click” innovation?
19. A company has an e-commerce model that allows investors to manage their patent portfolios through a unique computer algorithm that alerts them of important times to log on and buy or sell stock.
Formulate a few arguments, based on examples from the chapter, as to why this should be patentable.
20. How does the America Invents Act threaten the viability of business method patents?

CHAPTER 9. WHO IS THE INVENTOR?

1. Who is the inventor as defined by Patent Law?
2. Kathy, who was recently laid off from work at McDonald's, conceives a new valuable chemical and she reduces the invention to practice in her garage. Kathy's friend offers to give her \$100,000 to develop the chemical and to start a jointly owned company. Will Kathy's friend be named a co-inventor on the patent that will issue?
3. How does inventorship for patents differ from authorship for publications?
4. Tahlia is a graduate student who synthesized a new and unobvious molecule for her Master's thesis. She and her professor proceed to prepare a manuscript for publication in a learned journal. Tahlia asks her sister Jenna, who is working in the laboratory of a leather manufacturing company, to proofread her draft. Jenna recognizes that this new compound could be an important additive to facilitate leather tanning. Jenna persuades her sister to file a patent application prior to publishing her manuscript. Is Jenna a co-inventor? Elaborate.
5. How many inventors can be listed on a patent application?
6. What is conception?
7. What is reduction to practice?
8. An inventor who has been tinkering in his garage comes up with a new imaging technology. He sketches out the components needed to build his imaging machine, including complex diagrams and scales for his drawings. He then hires a friend who works for a high tech manufacturing company to build a prototype. Who conceived the idea for the invention? Who reduced it to practice?
9. A researcher, who works for Nike, comes up with a new system for using intricate air paths in the soles of running shoes to keep runners' feet cooler. He talks to a friend in development, who perfects the original design, including making changes to the air pathways for even better performance. Who conceived the idea for this invention?
10. Does reduction to practice have any bearing on who is listed as an inventor?
11. What are joint inventors?
12. A vice president of a pharmaceutical company charges his research directors to dedicate resources to funding a cure for a rare form of leukemia. Inspired by a naturally occurring substance known to have

mysterious therapeutic effects, a research director instructs a technician to try out hundreds of similar compounds. The technician ultimately finds one compound that can be turned into a medicine. Assuming that the compound or its use is patentable, who is the inventor?

13. The vice president for research of a large textile manufacturer instructs his research director to invent a new green finishing chemical for the textile industry. The research director realizes that the chemical must be a degradable peptide and accordingly charges his research chemist to find the appropriate peptide molecule. The chemist goes to work and identifies the specific peptide that works satisfactorily. The company decides to file for patent claiming a composition of matter. Who is the inventor, or co-inventor?
14. Stephanie invents a novel pharmaceutical compound that meets the requirements for patentability. Jeff invents an unobvious method for more efficiently manufacturing the compound, which also meets patentability requirements. Do they have to file a single patent application? Or can they file two separate applications?
15. What happens if someone makes a minor but critical contribution to an invention? If this person only worked on the project for a few minutes, can they still be an inventor?
16. Senior researchers in a company conduct a brainstorming session trying to complete an invention to bond glass to copper. They all agree on the general condition that a specific organic sulfur compound would do the job. The problem is that the sulfur compound does not properly wet the surface of the glass. A junior researcher suggests that the use of 1–2 percent of water in the formulation will help. Is the junior researcher a co-inventor?
17. What happens if several inventors intentionally omit the name of one of their co-inventors from the patent application?
18. What happens if one of the joint inventors goes missing before he signs the documents needed to apply for a patent?
19. Bernard works at a winery in the south of France. He conceives the idea for a new fabricated cork material that performs exactly like natural cork. Can Bernard file for a U.S. patent?
20. Tim works at the U.S. Patent Office. While weeding through a huge stack of applications for chemical patents, he conceives the idea for a new type of computer software that would be patent eligible.
Can Tim file for a patent?

CHAPTER 10. OWNERSHIP

1. Define “ownership.”
2. What rights do patent owners have?
3. In the absence of any contracts or agreements, who is the default owner of a U.S. patent?
4. If there are multiple patent owners, who among them can grant an exclusive license?
5. What is an assignment agreement and when might you be called upon to sign one?
6. Clara is employed by a large chemical company. She has signed an employment contract that includes a typical invention assignment clause. During her vacation she invents a new kind of zipper and reduces it to practice in her garage. Who owns the invention on the zipper?
7. Sue works for Exxon Mobil and has signed a typical invention assignment clause in her employment contract. On her fishing vacation in Canada, she invents a new catalyst to crack petroleum. Who owns the invention?
8. What is the Hired to Invent Doctrine?
9. John is an hourly worker in a large sulfuric acid plant. He did not sign an employment or a nonconfidentiality agreement. He conceives an ingenious bottle closure (a plastic cup) that prevents nasty acid spills and reduces it to practice in his garage during his vacation. Later he carries out further experiments with the cup at the plant. The company helps him to obtain a patent claiming the cup and the method of making it. Who owns John’s invention?
10. Beth works for Gojo, a company that makes Purell hand sanitizer among other things. One evening after work, Beth comes up with the idea for a brand new type of soap that rinses cleaner to prevent skin from drying out. Beth reduces the invention to practice on the weekends in her garage. Who owns the invention?
11. What is a “shop right”?
12. In Steve’s work as a janitor, he cleans a high-tech university lab. One evening, while sweeping the floors, he comes up with an idea to completely reorganize the lab’s polymer fabrication line to allow it to make new products. One night, he even spent a few hours rearranging the components to prove it would work. Steve files for a patent application and obtains a U.S. patent. Who can use the patented invention? And who can license the patented invention to others?

13. Even if an employee invents on her own time, can her employment contract stipulate that inventions made outside of work are still assigned to her employer?
14. What is a “non-compete agreement”?
15. What do courts look at in deciding whether to enforce a non-compete agreement?
16. Jan is hired by a small orthopedic device manufacturer located in Topeka, Kansas. She signs a non-compete agreement, which states that she will not work for another biomedical company anywhere in the United States for five years after leaving her employer. Two years later, Jan leaves her job and gets a new one working for a surgical device company in New York. Will a court enjoin (prevent) Jan from going to work at this new job? Will the court force Jan to pay damages to her former employer?
17. What is a “trailer clause”?
18. How did the Bayh–Dole Act of 1980 change the rules regarding patent ownership of inventions made with federal funding?
19. You have invented a new process funded with NSF grant money at The University of Akron, a state university. Subsequently, you and your adviser apply for a joint patent and the patent issues.
 - a. Who will be the owner/beneficiary of the patent?
 - b. Who can sell or license the patent?
 - c. What is the name of the law that regulates this situation?
 - d. What is the essence of this law?
20. How have the roles of universities changed in light of Bayh–Dole?

CHAPTER 11. TRANSLATING IDEAS INTO ECONOMIC REWARD

1. What are two of the major costs of filing a patent?
2. How does the America Invents Act decrease the cost of patenting for small businesses, universities, and independent inventors?
3. Why should a patent holder consider abandoning a patent?
4. What three types of assessment should an inventor perform before patenting an invention?
5. An inventor hires an independent researcher to replicate his results and to optimize his process for more efficient use in large-scale manufacturing. What type of assessment has the inventor done?

6. An inventor does an online search for other products in his field and then creates a table of competing products and prices. What type of assessment has the inventor done?
7. How can an inventor perform a rudimentary search to determine the patentability of her invention?
8. What two elements are required for trade secret protection?
9. Sometimes trade secret rights are chosen over patent rights.
 - a. State the advantages of trade secret rights.
 - b. State the disadvantages of trade secrets.(Do not contrast trade secrets and patents, just answer the questions.)
10. Jill is building a new kind of go-cart engine that will be mass-produced on an assembly line with dozens of employees. Should she patent the invention or protect it as a trade secret?
11. Ron is a chef who has developed a new method for extracting juice from pumpkins. An attorney has advised Ron that his method is patent eligible. Ron plans to only use the method in the restaurant kitchen he shares with his best friend Harry. Should Ron patent the method or protect it as a trade secret?
12. The formula of Smith Brothers Cough Drop is a closely guarded trade secret. You bought the product on the open market, analyzed it, and figured out the formulation. You started to market your own product under the trade name Akron Smakron. Smith Brother's management bought a sample of Akron Smakron at the corner drug store and determined that indeed you had their secret.
 - a. Should Smith Brothers contemplate legal action?
 - b. What would you recommend Smith Brothers to do?
13. What does the Economic Espionage Act do?
14. Can a trade secret be licensed?
15. What kind of agreement can an inventor use to protect an inventive idea that he wants to share with a researcher at a nearby university?
16. Can an inventor ever safely share an unpatented invention with a potential licensee? If so, how?
17. What are two ways an inventor can conduct a preliminary market assessment?
18. List at least three questions you should consider when assessing an invention's market potential.
19. Explain what a license is in one sentence.
20. What is the difference between selling a patent and licensing a patent?
21. Who are the *licensor* and the *licensee*?

22. What are an exclusive license and a nonexclusive license?
23. Why would an inventor want to license a patent rather than sell it?
24. What are the advantages of creating a company to commercialize an invention as compared with doing business without creating a formal legal entity?
25. What should an inventor consider when deciding whether to start a company rather than just licensing an invention?
26. What are the differences between a spinout and a joint venture?
27. What role do patent and technology transfer offices play?
28. What responsibilities does an inventor have to a corporate patent office or a university technology transfer office?
29. Why is valuing intellectual property important?
30. What methods can be used to value a patent? Why are these methods difficult to apply to patents?

CHAPTER 12. FOREIGN PATENTS

1. Can a U.S. patent be enforced in Canada?
2. Do most countries offer utility patents?
3. What is a “utility model” or “mini-patent”?
4. List at least two features of U.S. patent law that are not common in other countries’ patent laws.
5. The Patent Cooperation Treaty (PCT) established a uniform procedure for filing patent applications. The signatories of the PCT have agreed to a single standardized patent application.
What does the filing of a PCT (or “international”) application accomplish?
6. How persuasive is the preliminary report issued by the International Searching Authority?
7. How long does an inventor have to file a U.S. patent application if she first files a PCT application?
8. Give three potential reasons for filing a PCT application rather than a national application.
9. How does the European Patent Office differ from the International Patent Cooperation Union?
10. What are the European Patent Office equivalents of usefulness, novelty and unobviousness? How do they differ from U.S. requirements?

11. What happens when a patent is granted by the European Patent Office?
12. Why do some people compare European patents to identical twins?
13. Do you have to go through the European Patent Office to get a patent in any European nation?
14. What are the differences between English and German approaches to claims interpretation? Which approach does the U.S. use?
15. What is “delayed examination”?
16. Do all countries allow inventors to simply assign away their patent rights the way the United States does?
17. What do scholars mean when they say China extended patent rights before it extended patent protections?
18. What is TRIPS and why is it important?
19. What factors must an inventor weigh in deciding whether to file a foreign patent application?
20. Why do inventors need to look to the future when deciding whether to file a foreign patent application?

CHAPTER 13. INNOVATION

1. Give a definition of “innovation.”
2. Explain how invention and innovation differ.
3. Companies must innovate to survive; nonetheless, mature companies sometimes tend to be hostile to innovation.
 - a. Name the most important factor that determine the outcome of innovation.
 - b. Why is innovation so difficult in mature companies? Comment on the reaction of various business units/people in regard to innovation.
4. Give a few examples of successful innovations.
5. Why is innovation a pathway to job creation?
6. Is innovation a single event or a sequence of events? Explain.
7. Name the two models of innovation, and comment on their relative importance.
8. Contrast disruptive and incremental innovations.
9. Give an example of a disruptive innovation.
10. Why might academic researchers be less likely to contribute to innovation than their industrial counterparts?
11. What is the federal SBIR program? Is it an example of funding for basic research or for downstream innovation?

12. What are three examples of innovations funded by the federal government?
13. State the law of innovation and name its constituents.

CHAPTER 14. CONCLUDING THOUGHTS

1. What are some of the societal costs of the U.S. patent system?
2. Why is software an area of innovation that is more likely to be hindered by patents?
3. While the patent system does prevent people from making, using, or selling a patented invention for a limited time, it serves an important objective. What is that objective?
4. In your opinion, does patent law strike a good balance between creating an incentive for disclosure of inventions and allowing the public to use inventive ideas? If given the opportunity, would you make any changes to the patent system?
5. Do patents protect basic research or applied science?
6. How does the patent system foster competition? Elaborate.
7. What is inventing around?
8. Why is ignorance of the patent system dangerous to innovation?
9. The following exchange of words has taken place during the famous Drug Hearings between Senator Kefauver and Dr. Vannevar Bush, the director of National Science Foundation:
Sen. Kefauver: Suppose Dr. Fleming had taken out a patent on penicillin?
Dr. Bush: Ah, if he had, we would have had penicillin 10 years earlier than we finally got it.
 What is the point Dr. Bush tries to make? What does this dialog illustrate?
10. What is the relationship between inventing and investing?
11. What are the two “roots” of any patent?
12. Give a few examples of how patented technology has changed your life.

GLOSSARY

The words below are not meant to be complete definitions, but are intended to help readers understand some of the terms used in this book.

Abandonment. Giving up patent rights voluntarily by not completing the examination process or not paying maintenance fees.

Accelerated examination. An inventor can request expedited review of his patent application if the inventor is 65 years or older or if the invention is an advancement in the treatment of cancer or AIDS.

Advisory action. Communication by which a patent examiner rejects amended claims that were filed in response to a final office action. An advisory action means that the inventor's amended claims will not be allowed and a patent will not issue.

Aggregate. A new device or process that combines elements of previously known devices or processes in a manner that is obvious. Contrast this with composites—new devices or processes that combine previously known devices or processes in an unobvious manner and thus are entitled to patent protection.

Agreement of Trade Related Aspects of Intellectual Property (TRIPS). An international agreement, among members of the World

Trade Organization, that sets minimum standards for regulating intellectual property.

Amendment. In patent parlance, a change to the wording or content of a patent application's claims to overcome a rejection or objection made by a patent examiner. The term amendment can also refer to other types of change, including a change made to the language of the U.S. Constitution.

Annuities. Fees that must be paid to prevent patent protection from expiring. These fees must be paid 3½, 7½, and 11½ years after the patent has issued. Annuities are more commonly called maintenance fees.

Anticipation. If a prior art reference reads on a claim, that claim is not novel (was anticipated) and is therefore unpatentable.

Art. For our purposes, an area of research or technology development.

Assignment. The transfer of property rights in an invention from the inventor to someone else (person or corporation), usually by a previous agreement. This most frequently happens when an employee signs an agreement assigning his work-related inventions to his employer.

Bayh–Dole Act. A law passed in 1980 that gives universities, corporations, inventors, and other research institutions ownership of inventions made with federal funding.

Best mode. The best conditions for carrying out the invention known to the inventor at the time the patent application is filed.

Blocking patent. A patent that prevents a patent holder from practicing his patented invention. For example, a patent on a knife would prevent the patent holder of the switch blade from making, using, selling, or importing switch blades.

Budapest Treaty. An international agreement that allows inventors to deposit microorganisms in a central repository as a way of “describing” these organisms when they apply for a patent.

Chakrabarty. A case in which the Supreme Court held that living things are patentable as long as they meet the other requirements of Patent Law.

Claims. A series of statements about the patented invention that define the scope and boundaries of what the patent holder owns.

Composite. A new device or process that combines elements of previously known devices or processes in a manner that is unobvious and thus is entitled to patent protection. Contrast this with aggregates—new devices or processes that combine previously known devices or processes in an obvious manner and are not entitled to patent protection.

Composition of matter. One of the four classes of patentable things; usually chemical compounds.

Conception. The total mental part of the realization of the invention.

- Continuation (application).** A new patent application that allows the inventor to have another go at the examination process and to redraft the claims. The filing date of the original application is retained.
- Continuation-in-Part (CIP).** An extension of the patent application when new matter not disclosed in the original application is added.
- Contributory infringement.** Type of infringement that occurs when a person or company encourages or aids infringement—that is, when a component of the patented invention is sold knowing that the component will be used for infringing purposes. Also called indirect infringement.
- Copyright.** The right granted by a government to exclude others from copying, distributing, performing, or displaying a creative work, as well as creating derivative works based on the copyrighted work, for a limited time.
- Court of Appeals for the Federal Circuit (CAFC).** The court where most appeals from the Patent Office take place and the court which specializes in and interprets intellectual property law. Appeals from the CAFC go to the Supreme Court.
- Cover sheet.** First page of a patent or patent application, which contains a great deal of information about the patent like the name of the inventor, the owner of the patent, the patent number, and the priority date.
- Database rights.** A specific form of intellectual property right that allows owners of valuable databases to prevent others from copying or disseminating their work.
- Dependent claim.** The second tier of claims on a patent that stem from a broad independent claim and more narrowly define the invention.
- Derivation proceeding.** A legal proceeding, wherein one may show that claims in an earlier filed patent application were actually derived from the party initiating the proceeding.
- Design patent.** Protects the ornamental unique shape (design) of a man-made object—for example, the shape of a Coca-Cola bottle.
- Diligence.** Continuous activity toward completing the invention.
- Disclosure.** A written or oral description of the invention.
- Discovery push model.** An invention that occurred because it was interesting (or serendipitous), but was not meant to meet a specific need or to solve a particular problem. After the invention is made, a market must be found or created for the invention.
- Disruptive innovation.** A game-changing innovation that makes a system obsolete and replaces it with something better. Examples include the automobile and the personal computer. Contrast this with an incremental innovation.

Divisional Application. When a patent application contains more than one invention, the inventor must choose which one to submit for examination. The other invention can become the subject of a second application (the divisional application), which is entitled to the same priority date as the original patent application.

Doctrine of equivalents. A type of infringement that occurs when an invention performs the same function in the same manner and obtains the same result as the patented invention.

Doctrine of inherency. A characteristic that is necessarily present in an invention. Later inventors cannot claim this characteristic in a later patent application because it is by definition obvious.

Dominance. An earlier patent claim that reads on a later claim and prevents the later inventor from making, using, selling, or importing the invention without committing infringement.

Duty of candor. Legal obligation of a patent applicant to disclose everything he thinks is important to deciding whether his patent claims should be allowed. Failure to satisfy the duty of candor constitutes inequitable conduct.

Embodiment. An example or version of an invention described in a patent application.

Enablement. Requirement that the inventor must present detailed information to enable a person having ordinary skill in the art to reproduce and practice the invention without additional experimentation.

European Patent Convention. The agreement that created the European Patent Office and set some standardized rules for how patents should be interpreted by the countries that signed the Convention.

European Patent Office (EPO). Centralized patent office that has the authority to examine patent applications and grant patents for 38 countries, including most European nations and some states of the former Soviet Union.

Examiner. The person at the Patent Office charged with determining whether the applicant is entitled to patent protection.

Exclusive license. License agreement that promises that the patent will not be licensed to others, although the exclusive license may be limited to a particular geographic area or a particular field of use.

Experimental use. An inventor is excused of the one-year statutory bar on patenting after a disclosure if the public use or sale was for testing the invention or experimenting to improve it.

Field of use. As part of a license agreement, the patent holder may limit the license to a particular industry or type of activity (the field of use).

For example, the licensee may only be allowed to use the technology in the pharmaceutical market or as part of its process for manufacturing a particular type of cleaning chemical.

Final office action. The examiner's response to the inventor's first amendment of a patent application. (It is seldom final.)

First-inventor-to-file system. Method for determining who is entitled to a patent that is used by most industrialized countries, including the United States beginning March 16, 2013. The first person to file a patent application on an invention is entitled to the patent, unless someone can prove that the first filer actually stole the idea for his invention, rather than inventing it himself.

First Law of Inventing. An equation used in this book to describe the requirements for a patentable invention. $I = U + N + U'$, where I is invention, U is utility or usefulness, N is novelty or newness, and U' is unobviousness. Also called the Invention Content Law.

First office action. The patent examiner's response after the initial examination of the patent application.

First-to-file system. See First-inventor-to-file system above.

First-to-invent system. Method for determining who is entitled to a patent that was used by the United States through March 16, 2013. The first inventor to conceive the idea for the invention was entitled to the patent.

Freedom to operate. Ability to make, use, sell, and import a product or use a process without infringing on another person's patent rights or violating any applicable laws or regulations.

Hired-to-Invent doctrine. An employee is presumed to have assigned any inventions an employer specifically contracted for to the employer. Some people also call this rule the Work-for-Hire doctrine.

Incremental innovation. An improvement to an existing product or system. For example, the iPod was an incremental innovation that improved upon previous MP3 players. Contrast this with a disruptive innovation.

Independent claim. The first tier of claims on a patent that broadly define an invention and may be followed by more narrow dependent claims.

Indirect infringement. Type of infringement that occurs when a person or company encourages or aids infringement—that is, when a component of the patented invention is sold knowing that the component will be used for infringing purposes. Also called contributory infringement.

Inequitable conduct. Legal charge brought against a patent applicant that withholds relevant information, intentionally misleads a patent examiner, or otherwise fails to satisfy his duty of candor to the PTO. If an applicant

is guilty of inequitable conduct, the PTO will reject the patent application or declare any issued patent related to the conduct invalid.

Infringement. Making, using, selling, or importing a patented invention without authorization from the patent holder.

Injunction. A court order directing a party to stop a particular activity.

Innovation. As used in this book, the translation of an invention or an idea into a product or service for the marketplace.

Intellectual property. Ideas that someone has a right to develop and legally protect, such as by patent, copyright, trademark, or trade secret.

Intentional (or willful) infringement. Making, using, selling, or importing another person's invention with knowledge that one is infringing that person's patent. A patent holder, who proves someone committed willful infringement, can recover triple damages in court.

Interference proceeding. A lawsuit used to determine priority (who conceived the inventive idea first) when two inventors filed similar patent applications at about the same time under the old First-to-Invent system. Interference proceedings only apply to patent applications filed before March 16, 2013.

International application. Patent application filed in a Patent Cooperation Treaty receiving office that establishes a filing date in all PCT countries. Also known as a PCT application.

International Patent Cooperation Union. Countries that have signed the Patent Cooperation Treaty and have agreed to accept a single standardized international application.

Inter partes review. A legal procedure that can be used to challenge a patent after the post-grant review period has expired.

Invention (patentable). Any useful, novel and unobvious product or process that falls within statutory subject matter.

Invention Content Law. An equation used in this book to describe the requirements for a patentable invention. $I = U + N + U'$, where I is invention, U is utility or usefulness, N is novelty or newness, and U' is unobviousness. Also called the First Law of Inventing.

Invention Process Law. An equation used in this book to describe the steps one must take to create a patentable invention. $I = C + R_p$, where I is invention, C is conception, and R_p is reduction to practice. Also called the Second Law of Inventing.

Inventor. The person who conceived the idea for the invention or a component of the invention.

Joint inventors. Multiple people who each conceived at least one idea necessary to complete the invention or to make it operable, even if the

contribution is minor. All joint inventors must be named on a patent application.

Joint venture. Start-up company formed when two or more companies with complementary resources or expertise combine their assets under a collaboration or contract.

License. Permission by the patent owner for someone to make, use, sell, or import the patented invention.

Licensee. Person who acquires the right to make, use, sell, or import an invention from a patent owner.

Licensor. Patent owner, who contractually transfers part of her patent rights to another person or company.

Literal (or direct) infringement. Making, using, selling, or importing a patented invention without authorization from the patent holder.

Litigation. The process of filing and pursuing a lawsuit.

Machine. A device or apparatus used to perform a task. It is one of the classes of patentable subject matter.

Maintenance fees. Fees that must be paid to prevent patent protection from expiring. These fees must be paid $3\frac{1}{2}$, $7\frac{1}{2}$, and $11\frac{1}{2}$ years after the patent has issued. Maintenance fees are sometimes also called annuities.

Manual of Patent Examining Procedures. The “bible” of patent examiners, patent attorneys, and patent agents that offers more than 2000 pages of guidance on patent procedures and practices.

Manufacture. Any item made by a human or machine that is not classified as a machine. It is one of the classes of patentable subject matter.

Method. A series of steps producing a useful, novel, and unobvious thing. More commonly called a process.

Need (or market) pull model. An invention that results from persons attempting to meet a specific need or find a solution to a specific problem.

Negative right. The right to prevent someone from doing something. A patent gives its owner the right to exclude others from making, using, selling, or importing a product or service that is based on the patented invention.

New matter. Technical information not included in the original patent application.

New use. The invention of a new and unobvious use for an old invention.

Non-compete agreement. A contract that prevents a current or former employee from going to work for a competing company.

Non-disclosure agreement (NDA). A contract that requires the recipient of information to make a legally enforceable promise that she will not share the information with others or use the invention herself without permission.

Nonobviousness. The most difficult requirement of patentability; it demands that the invention produce unusual and surprising results. We call the requirement unobviousness in this book.

Non-publication request (NPR). Filing that asks the PTO not to publish a patent application for more than 18 months after it was filed. The NPR must state that the patent applicant does not intend to file any foreign patent applications.

Notebook. Signed and dated journal in which an inventor records the conception, experimentation, and reduction to practice of his invention.

Notice of allowance. This document is issued by the Patent Office informing the applicant that his application meets the requirements for patentability.

Novelty. Patent Law requirement that an invention cannot be described in a printed publication, publicly used, put on sale, or otherwise available to the public before a patent is filed. The one-year rule is related to this requirement.

Oath (or declaration). Signed legal document in which an inventor swears that he believes that he and his co-inventors are the original and first inventors of the invention.

Objection. The examiner's disapproval of a nonessential matter during the first office action. An objection is generally based on the form, rather than the content, of a patent's claims.

Office action. The examiner's response to the applicant specifying the deficiencies of the application. The examiner's reasoning why the claims were rejected.

Official Gazette for Patents. A weekly publication of the Patent Office that lists all the patents issued that week, showing the abstract, a representative claim, and a representative drawing.

One-year rule. The inventor must file a patent application within one year of when he discloses the invention. Otherwise, the invention fails the novelty requirement and becomes unpatentable. See also statutory bar.

Ownership. A bundle of rights in a property. For Patent Law, ownership includes the right to prevent others from making, using, selling, or importing the patented invention during the period the patent is active.

Parent application. The first in a series of related patent applications. Parent applications are generally followed by continuation, continuation-in-part, or divisional applications, all of which are "children" to the parent application.

Patent. A grant by the government to the inventor that confers the right to exclude others from making, using, selling, and importing the invention for a limited time.

Patentable creativity. As used in this book, the capacity of the prepared mind to recognize and satisfy a need in a new, useful, and unobvious manner for society's benefit.

Patentable subject matter. The five classes an invention must fall into to be patentable: processes or methods, machines, manufactures, compositions of matter, and improvements of the other categories.

Patent agent. A patent professional who has passed a certifying exam (the Patent Bar) and can file patent applications and communicate with patent examiners. Unlike a patent attorney, a patent agent does not have a law degree.

Patent application. A set of documents disclosing the invention filed at the Patent Office to apply for a patent.

Patent attorney. A licensed attorney who has passed a certifying exam (the Patent Bar) and can file patent applications, communicate with patent examiners, and represent patent holders in court.

Patent auction. Event at which a patent or portfolio of patents are sold to the highest bidder. Some companies are forced to auction their patents during bankruptcy proceedings.

Patent Cooperation Treaty. An international agreement by which inventors can file International Applications in a member country and, after a preliminary search of prior art, have the application forwarded to other member countries for independent patentability determination.

Patent Law. Title 35 of the United States Code, which defines the requirements for obtaining a patent and the rights of patent owners.

Patent pending or pendency period. The time period between the application and issuance of a patent. It is a criminal offense to advertise "patent pending" in the absence of a patent application.

Patent troll. Company or person that uses patents purely as a means of suing those that infringe its patent rights and that has no intention of making, using, or selling the patented invention it owns.

PCT Application. Patent application filed in a Patent Cooperation Treaty receiving office that establishes a filing date in all PCT countries. Also known as an International Application.

Pendency. See patent pending.

Patent prosecution. The process of navigating the patent application through the Patent Office.

Patent Rules of Practice. Official administrative regulations the examiner uses during patent prosecution.

Patent Trial and Appeal Board (PTAB). An administrative body made up of patent law judges that hear inventors' appeals of decisions by patent examiners.

Personal defense. An assertion that prevents its proponent from being successfully sued and that only applies to specific people or entities. The prior commercial use defense is a personal defense.

PHOSITA (person having ordinary skill in the art). Hypothetical “ordinary” scientist that can only make obvious discoveries and is used as a standard for testing whether an invention is unobvious.

Plant patent. A patent issued for a new asexually reproducing plant.

Post-grant review. Legal proceeding that allows anyone to challenge the validity of a patent for any reason except failure to disclose a best mode, so long as the challenge is brought within nine months of when the patent is issued.

Predictable arts. Fields of scientific study, like mechanical and electrical engineering, where the usefulness of an invention can be assumed. Patent applications in these fields will be granted even without supporting experimental data. Contrasted with unpredictable arts.

Preferred embodiment. Synonymous with best mode.

Product champion. The entrepreneur who drives the scientific, technical, and managerial activity that turns an invention into an innovation.

Product-by-process claim. A patent claim protecting the method by which a product is manufactured.

Prior art. Publicly available knowledge and experience that existed before the priority date on a patent application.

Prior commercial use rights. Legal defense that prevents a patent owner from successfully suing a person or company that had been making, using, or selling an invention before the inventor filed for the patent.

Priority date (or effective date). The date used to establish the novelty or unobviousness of an invention as related to other art. A patent application with an earlier priority date is said to “have priority” over later applications. A priority date may differ from the patent’s filing date, such as when an inventor files a provisional application and then a regular application.

Process (or method). A series of steps producing a useful, novel, and unobvious thing.

Prophetic patent application. A patent application that does not contain working examples only prophetic or anticipated future examples, but nevertheless contains sufficient detail to enable a person having ordinary skill in the art to practice the invention.

Prosecution. See patent prosecution.

Provisional patent application. A document filed at the Patent Office, which details how to practice the invention and establishes a priority date. It must be followed by a regular or nonprovisional patent application within one year.

Read on. Pertinent prior art that covers the same invention as the one claimed in a patent application is said to “read on” the claims. It destroys patentability.

Rebuttal. Responses by an inventor or his patent attorney or agent to a patent examiner’s rejections and objections.

Reduction to practice, actual. Demonstrating experimentally the feasibility of an invention.

Reduction to practice, constructive. The filing of a prophetic patent application containing sufficient detail to enable a person having ordinary skill in the art to practice the invention.

Reissue application. An application to correct an existing patent (e.g., to recast claims, correct errors or disclose relevant new reference).

Rejection. A claim that is not allowed by a patent examiner is rejected.

Request for continued examination. The document, containing new claims, new references, and so on, that the applicant files when he wants to continue prosecuting a patent application after receiving a Final Office Action.

Restriction. Formal objection cited by a patent examiner when an inventor claims more than one invention in her patent application.

Royalties. Money paid by a licensee to the intellectual property owner based on the commercial success of the intellectual property.

Sale. In the case of patents, transferring all patent rights to a new owner. This contrasts with a license in which a patent owner maintains ownership of the patent but gives another person the right to make, use, sell, or import the patented invention.

Search. The examination of prior art to determine novelty, unobviousness, or freedom to operate.

Second Law of Inventing. An equation used in this book to describe the steps that one must take to create a patentable invention. $I = C + R_p$, where I is invention, C is conception, and R_p is reduction to practice. Also called the Invention Process Law.

Shop right. Rule that an employer retains an automatic nonexclusive license to use an invention that its employee developed using employer resources but that the employee was not hired to invent.

Specification. An essential part of the patent that details the invention such a clear manner that a person having ordinary skill in the art is able to practice the invention without undue experimentation.

Spin-out. Start-up company based on university or corporate intellectual property.

Start-up. New company created to commercialize a product or technology. Spin-outs and joint ventures are types of start-ups.

Statute. A law created by a legislative body.

Statutory bar. A law that prohibits a person or company from taking a particular action. For example, publication, public use, or sale of an invention more than one year before filing a patent application is a statutory bar to patentability.

Statutory subject matter. The five classes an invention must fall into to be patentable: processes or methods, machines, manufactures, compositions of matter, and improvements of the other categories.

Submarine patent. A patent that issues after an unsuspecting company begins to produce infringing products.

Supplemental examination. Process through which patent holders can disclose information to strengthen their patent or correct inaccuracies.

Swear behind. The inventor makes an oath that he reduced his invention to practice on some date before a prior art reference that makes the invention obvious or not novel.

Technology transfer. Process of turning research, which is often protected by patent, into a marketable product or service.

Trademark (or servicemark). A form of intellectual property protection that applies to a word, phrase, symbol, or design that is used in commerce to identify or distinguish a product from others.

Trade secrets. Confidential formulas, practices, and know-how that are protected only by their secrecy and that give the trade secret holder a competitive advantage.

Trailer clause. Agreement that assigns all inventions developed by an employee within a set time period following the end of her employment to her former employer. The theory is that an employee may have conceived the idea for the invention while working in the company.

TRIPS (Agreement on Trade-Related Aspects of Intellectual Property Rights). An international agreement, among members of the World Trade Organization, that sets minimum standards for regulating intellectual property.

Unobviousness. The most difficult requirement of patentability; it demands that the invention produce unusual and surprising results. Also called nonobviousness.

United States Code Title 35. The U.S. Patent Law that defines the requirements for obtaining a patent and the rights of patent owners.

United States Patent and Trademark Office (USPTO). Office of the federal government responsible for searching prior art and issuing or denying patent applications.

Unpredictable arts. Fields of scientific study, like biotechnology and pharmaceuticals, where one cannot assume that a new discovery will be usefulness. Patent applications in these fields require supporting experimental data. Contrasted with predictable arts.

Utility. Requirement that an invention must have some plausible useful purpose in order for it to be patentable. In practice, this means that the patent application must include an assertion of usefulness and an indication on “how to use” the patent.

Utility patent. The most common type of patent granted for useful, novel, and unobvious compositions, processes, machines, or manufactures for a limited time.

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