CHAPTER 1

BACKGROUND AND HISTORICAL PERSPECTIVE ABOUT INTELLECTUAL PROPERTY

CHAPTER OBJECTIVE

The objective of this chapter is to provide the reader with an overview of the concept of intellectual property. Many new terms will be introduced here and discussed in detail later throughout the remaining chapters. In a similar manner, the examples introduced here will be used and expanded in later chapters. With this introduction, you will begin to understand that inventing or expressing in words something believed to be technically novel is only the beginning; you must determine within the world information domain if it really is novel as a matter of law and then pursue the necessary steps to obtain a patent, copyright, trademark, or just keep it as a trade secret.

INTRODUCTION

The human intellect can create a novel, new, or not currently known concept, idea, or thought in the mind. Therefore, intellectual property

Writing Chemistry Pantents and Intellectual Property: A Practical Guide,
First Edition. Francis J. Waller.

is an intangible creation of the intellect. When a novel concept or idea is reduced to practice by someone, the inventor, it now becomes a tangible creation that can be protected by a patent. For example, say your novel concept is to capture sunlight to convert water to hydrogen and oxygen.

$$H_2O \xrightarrow[\text{catalyst}]{} H_2 + 0.5O_2$$

The *reduction to practice* or how your invention would work has three key components. First, you need a bimetallic nanoparticle. Second, the nanoparticle activates water to generate hydrogen atoms and an epoxide connected to the surface of the nanoparticle. Third, hydrogen and oxygen are released from the surface of the nanoparticle. You must further define the nature of the bimetallic character of the nanoparticle and describe the nanoparticle: particle size, particle composition, and bimetallic loading. Remember, not all metals in combination would function as a bimetallic catalyst for this reaction. In addition, the particular particle composition must be able to form an epoxide and connect to hydrogen atoms. Also the release of hydrogen and oxygen from the surface of the nanoparticle may require a desorption process, which may be heat activated. Therefore, you can readily see, to come up with a novel concept and then to determine how it would work are not easy operations. But eventually, when the specifics of the reduction to practice are worked out and a model is demonstrated, you have an invention. Similarly, when you commit your thoughts to paper or screen, the tangible expression can be protected by a copyright. Therefore, legal protections of tangible creations include patents and copyrights. Other legal protections include trademarks and trade secrets.

If you visit a Java City coffee shop and purchase coffee in their container, you will quickly note that the words *Java City* on the cup are followed by a ™ symbol. The ™ symbol means "trademark." Also, on the side of the container, there appears © *2007 Java City, Inc. All Rights Reserved*. This phrase means that the text on the back of the coffee container is protected by a copyright. The © symbol means "copyright". Now if you read the text, part of a sentence reads "using a unique time-signature process." This could mean that Java City, Inc. may have a patent on some unique process to roast the coffee beans or the referenced unique process could be protected by a trade secret. So the use of the different forms of intellectual property could give Java City, Inc. a competitive edge in the marketplace. The symbols ™ and © will be discussed further in another chapter.

Before I began to pull intellectual property examples together to illustrate various points in this book, I noticed that I had several pencils

on my desk. One has the Penn State® logo and eleven paw prints. Next to each paw is the notation ™. Both of these symbols, ® and ™, refer to trademarks. The ® is used to indicate that the trademark is federally registered. The ™ symbol usually, but not always, means the potential owner of the trademark has filed for federal registration for a class of goods but not yet received it.

Recently, I was reading the S*mart Money*® magazine[1] and noticed an advertisement for AT&T®. Toward the bottom of the page were the words "© 2009 AT&T Intellectual Property and AT&T, the AT&T logo, all other marks contained herein are trademarks of AT&T Intellectual Property and/or AT&T affiliated companies." I think from this and the earlier examples you can see that companies take the use of their trademarks and copyrights very seriously. So as you read other advertisements, look for the ©, ®, and ™ symbols, and you may be surprised at how many logos and unique sets of words or phrases are actually protected by trademarks while the written expression is protected by a copyright. Even this book is copyright protected.

Intellectual property is all around us. In 2008, J. K. Rowling, the author of the best-selling Harry Potter book series, and Time Warner, Inc., were engaged in a copyright trial in federal court against RDR Books.[2] In this example, RDR Books was planning publication of a Harry Potter reference guide. At issue in this trial was the question of whether RDR Books took too many quotations and plot summaries from Rowling's work. Here the copyright doctrine of *fair use* was being challenged. Fair use allows a limited amount of copyrighted material to be incorporated into another author's work without requiring permission from the copyright owner under certain situations. These situations include scholarly work and critiques for noncommercial purposes. However, I believe, the reported reference guide here was for commercial purposes. In the trial, the judge halted publication of the Harry Potter reference guide. He ruled that the reference guide would violate the copyright owned by Rowling because fair use was not being followed. One must remember that using an unnecessary amount of verbatim material from another work that is protected by a copyright can lead to litigation. Apparently, RDR Books did not change the original work with any new meaning or commentary. In the Preface, I noted that if your product is worth a very large amount of money in the marketplace, your intellectual property may be challenged through litigation. The Harry Potter series is very popular and successful in the marketplace. Further discussion about copyrights will be presented in Chapter 11.

Another example of intellectual property in the news occurred in 2006 with the Coca-Cola Co. when they alleged the stealing of

confidential documents and a sample of a new coke product.[3] Three employees of Coca-Cola Co. were alleged to have tried to sell the items to Pepsi Co., Inc. The confidential documents were deemed trade secrets. Trade secrets, if protected adequately, will give the holder of the trade secrets certain rights if the trade secrets end up in a competitor's hands. Remember, the long-used syrup formula that gives Coca-Cola® its unique flavor is still a trade secret. Further discussion about trade secrets will be deferred until Chapter 3.

The last example of intellectual property from the press is Medtronic® suing Boston Scientific® in 2006 for patent infringement.[4] This case involved stents to prevent blockages in coronary arteries. The stent market was about $4 billion in 2008. A U.S. District Court in Texas found Boston Scientific® had infringed three patents used by Medtronic®. The judge ruled that Boston Scientific® must pay Medtronic® $250 million. However, in 2008 a federal judge found two of the Medtronic® patents unenforceable. The judge reduced the $250 million damages to $19 million. In more recent court decisions, Boston Scientific® may also have infringed patents held by Johnson & Johnson® involving heart stents. It can readily be seen that the major manufacturers of heart stents are involved in patent infringement litigation. In fact, some of the litigation goes back a decade! Again, this points out that if you've developed an innovative product that's worth very large amounts of money in the marketplace, your intellectual property may be challenged through litigation.

A more detailed discussion about patents, valid claims, infringement, and enforceability will be discussed in later chapters, but this brings up an important point regarding patents. For a patentee, the owner of a patent, to succeed in litigation, getting the patent application nearly correct the first time is very important. As an inventor, you do not want your patent application finally rejected by any patent office, nor do you want to have invalid claims. Patent claims do not, by law, infringe other patent claims. Making, using, offering to sell, selling, or importing into the United States a patented invention is what infringes patent claims. If the claims of one patent were identical to the claims of an earlier patent, those claims might be invalid as anticipated. Those claims, however, would not infringe the claims of the earlier patent. The manufacture, use, offer for sale, sale, or importation of a product falling within the scope of those claims, however, might infringe the claims of the earlier patent.

Some people may have a dilemma about patenting in the field of human health. Should one allow science or technology that pushes forward research in human health to be put into the public domain and

therefore available simultaneously to many people? Or should one patent the invention and make it available only to those who can pay? Possibly two pathways are available to the original inventor. If the original inventor in an emerging technology area does not obtain patent protection, he or she may be prevented to practice their own invention by later patents allowed in the same area by someone else. A case in point occurred in 2006 when S. Yamanaka, a stem-cell researcher at Kyoto University, created the first iPS cells.[5] By introducing just four genes into mouse tail cells grown in a lab dish, he could produce cells that looked and acted like ES cells. These new cells were called induced pluripotent stem (iPS) cells. Kyoto University fast-tracked the Japanese patent application on the method covering the discovery of four genetic factors to reprogram the cell. This patent was eventually allowed and gave Yamanaka the right to carry out his own research. A patent normally gives the inventor the right to exclude others to practice the invention. However, since the method was the first of its kind and there was no close *prior art*, Yamanaka can practice his own invention. Therefore, if you have a novel invention and the novel invention represents a paradigm shift in science or technology, you are the dominant intellectual property holder and can practice the invention. It pays to be first with novel technology because there is no prior art references (including patents). The second pathway for the original inventor is to publish the invention in a scientific article. This pathway would allow everyone to practice the discovery. In later chapters, keywords such as *allowed patent, definition of a patent*, *prior art*, and *method patent* will be discussed in more detail.

As an intellectual property writer, it is important for you to understand that intellectual property is worldwide. Patents, copyrights, and trademarks are being applied for every day. Science and technology normally move at a rapid pace. Rapid advancement of science should encourage you to act quickly to file your own patent applications, submit a copyright on original tangible works, or obtain a trademark that distinguishes your product from another product. As an example, the number of U.S. patents for technologies from India increased more than 10-fold from 1993 to 2003. One fifth of all U.S. chemical patents were granted to Japanese inventors during roughfully the same time period. In 2007, about 8% of inventors were identified as having a Chinese surname. The reason for being aware of these facts is that many inventors file patent applications in their own country and in the United States. Later in the book we'll discuss worldwide prior art searching, but for now simply be aware that you must examine all printed information pertaining to the technology field that is covered

by your invention. Printed information includes not only where it is published but also in any language. The same would apply to information that has a copyright. The expression of words on some tangible medium can occur anywhere in the world. Consider when you use Google® to search a topic to find out what has been written about it. The number of worthwhile hits sometimes is staggering.

BOOK STRATEGY FOR PATENTS

Figure 1.1, shows the basic elements one must comprehend before writing a patent application; these elements will be covered in later chapters. The written patent application or specification is made up of two parts: invention description and claims. The claims must be valid and nonobvious over the prior art. The description must disclose your invention adequately and enable a skilled artisan to make and use your invention. There are also a series of legal requirements you must follow. These include following proper format; paying required fees; and ensuring that the invention is useful, novel, nonobvious, and belongs to a statutory class eligible for patent protection. Not following or proving the legal requirements to the patent examiner will lead to a rejection.

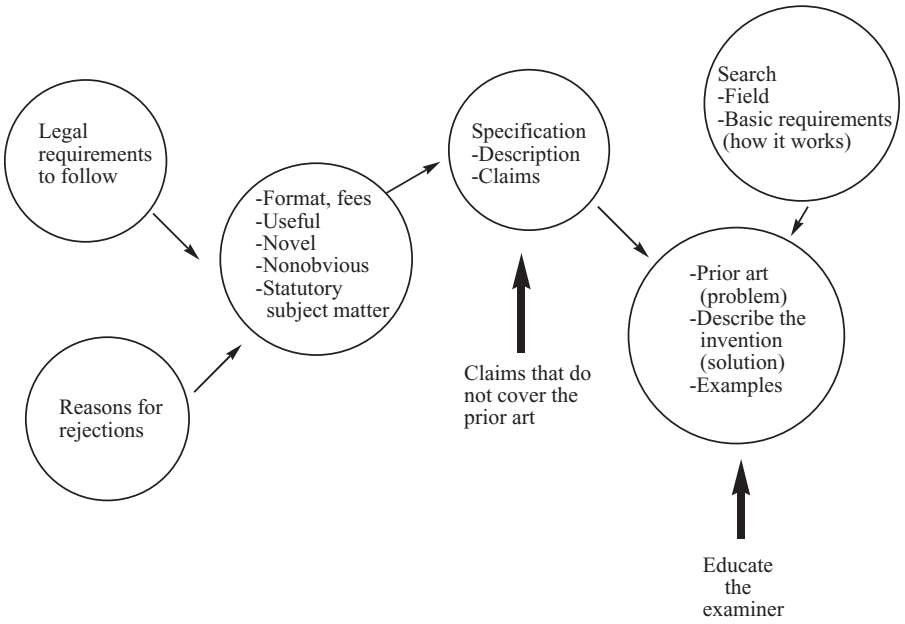

Figure 1.1. Basic elements for a successful patent application.

As we begin to discuss various aspects of patents in later chapters, reflect back on Figure 1.1.

A BRIEF HISTORY OF PATENTING

Patent laws were first established in the United States in 1790. Patent numbering started in 1836. Early on in patent history, a working model of an invention was required when you filed a patent application. Luckily, this requirement was dropped several years later. The U.S. Constitution gives Congress the power to enact laws relating to patents. Under this power, Congress has enacted laws relating to patents up to the present time. For example, in 1980, the Bayh-Dole Act gave universities title to ownership of inventions resulting from research funded by the federal government. Before that time, title belonged to the government. In 1984, the Hatch-Waxman Act was passed. This act allowed generic drugs to enter the marketplace. Before 1984, generic drugs were not very common. After 1984, the generic drug company was required only to demonstrate bio-equivalency of the generic drug. In addition, the generic drug company receives the benefit of clinical trial data from the drug company. In return, the drug company received a maximum of up to a 5-year extension on the patent life.

The first historical reference to a body responsible for issuing and archiving patents goes back to 1679, with the creation of the General Board of Trade and Currency of Spain. This board had the responsibility of increasing economic growth. Invention rights in Spain, however, were granted before 1679 by the king of Spain in the 15th and 16th centuries.

Recently, there has been a lot of discussion on the question of whether assessment of damages in patent infringement cases should be based on the extent to which the most recent patent improves on the previous patents. Presently, there is not a limit on damages. For example, if your invention is a novel light-emitting organic or polymer material used in a light-emitting diode (LED) that is part of an HDTV set, should you receive damages on the light-emitting organic or polymer material or the whole HDTV set, which is made up of many interacting components that are functionally different? Damages now are based on the whole HDTV. Patent lawsuits have increased substantially in the last 20 years (Table 1.1). There was an increase of 63% from 1986 to 1996. The next 10-year period shows an increase of 54%. In 2006, there were approximately 2800 lawsuits in U.S. courts. Again, this reflects the many products in the marketplace worth billions of dollars.

TABLE 1.1 Patent Lawsuits

Year	Number of Lawsuits	10-Year Percent Increase
1986	1,129	—
1996	1,840	62.9
2006	2,830	53.8

This is not to say that some of the litigation originates from companies or individuals with other agendas. An example is *patent trolls*. These are companies or individuals who buy patents from other companies or individuals with the purpose of not making any particular product but to extract royalties or be awarded damages when their patent claims are infringed. Many times these are frivolous lawsuits that may be cheaper to settle out of the U.S. court system. The patent trolls however, also have the financial and human resources to file their own patent applications on products or methods, again with the same objective of finding companies that infringe their patent claims. This example should put into perspective that it is very important to have a patenting strategy when you are nearly ready to launch a new commercial product. A well-thought-out patenting strategy may make it more difficult for patent trolls to have a negative impact on your new commercial product. A brief discussion about patenting strategies is found in Chapter 12.

INTELLECTUAL PROPERTY: IS IT IMPORTANT OR NOT?

Presently, novel discoveries or products are usually protected by patents. This allows the holder of the patent to commercialize the discovery. Also, expression of words are protected by copyrights. As an example, copyrights help writers and book publishers recoup their time and expenses for publishing a book.

Some people are advocating that protection of intellectual property was important during the Industrial Age, but as we move further into the Information Age, all information should be freely exchanged and less protected by patents[6] or copyrights. This approach would decrease litigation in the courts. Since 1990, litigation in particular infringement cases has increased more than 400%. However, there is a possibility that scientific researchers—individuals, collaborators, or corporations—may not financially benefit from their discoveries if not for some protection mechanism. With no intellectual property protection, the cheapest producer could manufacture the product. The cheapest producer may not be associated with the original inventors. This situation

now exists when exclusive patent rights expire. A case in point is the generic drug–manufacturing companies.

Is there an alternative approach to patents? Ideas have value, and the perceived value increases when more people have input to the idea. The sticky point is when the idea is reduced to practice into a tangible product. If the tangible product is sold and represents a paradigm shift in technology, how are the monies from that unique product distributed so that everyone from the idea generator to manufacturer is rewarded for his or her effort and therefore encouraged to repeat with a similar effort? Maybe the objective and fair approach would be an organization that collects the money from sales and distributes it to the appropriate parties from the original idea generator to the final manufacturer. One may want the low-cost manufacturer so that the product has global appeal. The distribution system organization would benefit humankind just like patents, trademarks, and copyrights. The new idea could be disseminated freely, since it would not be protected by patents, trademarks, or copyrights.

However, presently we have patents, trademarks, and copyrights that confer rights to their holders. Critics continue to propose changes to the existing intellectual property system. Maybe we need a drastic new approach to bringing products to the marketplace where everyone along the new product chain benefits. Only time will tell if people without hidden agendas can make a different innovation system work. It may not be the crude distribution system organization just described but something that fosters innovation, rewards the participants, and is fair and objective and that everyone can live with because it will continue to benefit humanity.

THE U.S. PATENT AND TRADEMARK OFFICE

The U.S. Patent and Trademark Office (USPTO) has been located in Alexandria, Virginia, since 2006. (It used to be in Arlington, Virginia.) The USPTO receives both patent and trademark applications. Table 1.2 shows that the number of patent applications has increased by 73% from 1987 to 1997 and by 98% from 1997 to 2007. About 181,100 patents were issued in 2007, compared to 137,122 issued in 1987. Over time, the large volume of applications to be examined has caused a backlog. In 2010, about 700,000 patent applications had not yet been evaluated by an examiner. Presently, about 450,000 patent applications are received yearly. This growing backlog of patent and trademark applications is expected to increase between 700,000 and 1 million in

TABLE 1.2 Patent Applications by Decade

Year	Number of Patent Applications	10-Year Percent Increase
1987	137,122	—
1997	237,045	72.9
2007	468,330	97.6

2010. To help rectify the backlog of applications, the USPTO hired an additional 1,500 patent examiners in 2007 and in 2008, bringing the number of examiners to about 5,500. In 2010, the number of examiners stood at about 6,000. The good news from the hiring is the backlog of patent and trademark applications should be slowly reduced. However, because about 50% of the examiners are relatively new, many will have to be mentored in the patent office procedures and assigned to the examining technology centers based on their expertise. Each center has jurisdiction over a selected group of assigned fields of technology. With the worldwide economic slowdown staring in 2008, the USPTO has seen a slight reduction in applications. This translates into a loss of revenues. How the economic slowdown affects the USPTO plan for growth and training new hires remains to be seen. The global slowdown could possibly extend into 2012.

Patent examiners see their jobs as helping inventors protect their intellectual property. If you have an opportunity to interview an examiner in the presence of your attorney, listen carefully to what may be bothering the examiner if you were sent a rejection notice. This meeting is your chance to resolve any scientific or technical questions in a face-to-face discussion. Written responses are still required to respond to a rejection notice; however, so much more can be covered in a one-on-one discussion. Each company has a different policy about visiting a patent examiner. In all my trips to the USPTO, the outcome has always been favorable to the allowance of my patent.

Patent allowances by the USPTO have changed over time, and the percent change is instructive from a historical point of view. The allowance history is reflected in Table 1.3. Before 1999, the patent allowance rate by the USPTO was about 65%. Then from 1999 to 2000, the rate increased to 72%. This high rate of allowance probably was a result of a rapid examination. Rapid examinations can lead to issued patents with invalid claims since the examiner's own prior art search may not have been sufficiently thorough. The difference between an allowed patent and an issued patent is a fee paid to the USPTO. In 2006, we saw the rate of allowance falling to about 45%. In 2009, the rate of

TABLE 1.3 Patent Allowances

Years	Rate of Allowance (%)
2006	45
1999–2000	72
Before 1999	65

allowance fell further to just under 40%. Therefore about one out of every three or so patent applications are allowed. What does this mean to you? Certainly the USPTO is being more diligent in their prior art search to determine if your invention already exists or is obvious to a person with ordinary skill in the art. Most likely more patent applications are being rejected by the USPTO because in the last decade, critics of the patent system have ascertained that many of the issued patents are obvious, have invalid claims, or are only incremental improvements over existing patents. The latter can lead to more infringement because the inventor is making an improvement in a technology area that is already dominated by existing patents and patent estates.

The average time spent by a patent examiner on a chemical patent is a mere 20 hours. Therefore, you and your patent attorney should have all the submitted paperwork correct and a well-thought-out specification for the patent examiner to read. The specification is the written description of the invention with the corresponding claims. It is important to mention here that since the patent examiner spends only a total of 20 hours evaluating your patent application, you should make his or her job easier. Do not overburden the examiner with prior art references that are not relevant. In the written description of the invention, summarize the status of the prior art and identify the problem that researchers are trying to solve. Then very clearly state how your invention solves the problem or fulfills the marketplace need. Always spend adequate time to discuss how your invention is not obvious based on the prior art. Many times if the examiner must spend too much time trying to determine why your novel invention is the solution to the problem, he or she will simply reject the patent application and wait until you and your attorney explain why your invention is novel, useful, or not obvious in your written response. In Chapter 5, we will spend time on the concept of *obviousness*. Usually this is a common rejection from the USPTO. Through writing patents during my 30-year industrial career, I have found that being proactive in doing the necessary homework while writing the specification of the patent application is much better than responding to a rejection. The first take-away messages in

TABLE 1.4 Preexamination Period Activities

Serial number assigned
Fees recorded
Tentative classification in a technology field
Security-sensitive material screened
Security-sensitive cases separated (not published)
Administration duties performed

TABLE 1.5 Examination Period Activities

Application assigned to examining unit and examiner
Classification in technology field completed
First office action from examiner
Applicant's response to office action
Second office action or allowance
Possible applicant's response to office action
Examiner's last office action
Final allowance or rejection

TABLE 1.6 Postexamination Period Activities

Review of allowed application and all paperwork
Electronic data capture for printing
Fees collected
Patent printed and issued

writing a patent specification is to state the problem to be solved, clarify how the invention solves the problem, and explain in clear language how each prior art reference points away from the invention.

The examination by the USPTO is broken up into a preexamination period, examination period, and postexamination period. Some activities in each period are summarized in Tables 1.4–1.6. In the preexamination period, most of the activities are not performed by the patent examiners. This stage takes approximately three months, and two fees are paid to the USPTO: a basic filing fee of $330 and an examination fee of $220. The most important point here is that security-sensitive patent applications are not published. Next, the patent application enters the examination period (Table 1.5). The total cost at this stage is $540 for a search fee and $1,510 for an allowance fee if the patent application is allowed. The time required to go through all of the activities for this stage is up to 26 months.

Even after the last office action, the inventor has time for another response if an additional fee is paid. Usually the time between all the

responses is an average of 8 months out of the 26 months. In the postexamination period, 2 to 3 months are required to complete all of the activities outlined in Table 1.6. From the time the patent application arrives in the USPTO until the time it is issued as a patent, the total cost is about $2,600. This will keep the patent enforced for 3.5 years before the next set of fees are required. Then just before 3.5 years, 7.5 years, and 11.5 years have elapsed, maintenance fees of $980, $2,480, and $4,110, respectively, are due (The example discussed here is for a utility type patent.). Therefore, the lifetime patent costs are about $10,170. This does not include any patent attorney fees. In the case of most utility type patents, exclusive rights are assigned to the inventor for 20 years. If you have been keeping track of time in the overall examination process, 31 to 32 months have elapsed. In 2009, it took about 40 months for some allowances. It should be mentioned here that your patent application will be published by the USPTO after 18 months from the date of submission to the patent office. This publication can be prevented under special considerations which will be discussed in a later chapter. Later, we will also discuss such terms as *issued patent*, *utility patent*, *filing date*, and a *Non-publication Request*.

Before we leave this section, it should be mentioned that every word in your issued patent and every word in your claims will be scrutinized carefully by your competition. Therefore, proofreading a patent should be a high priority after it is issued. Make sure there are no typographical or grammar mistakes that could influence the interpretation of the patent. Also the USPTO may omit information that was changed by the applicant (you) during the examination period.

WHY INTELLECTUAL PROPERTY PROTECTION IS CURRENTLY IMPORTANT

Patents are obtained to protect an existing business. Patents will also protect new businesses. Many companies will license a patent and obtain royalties. Patents will also exclude others from entering emerging technology that is new and on the cutting edge of science.

Approximate drug developmental costs since 1992 are summarized in Table 1.7. There is an ongoing debate if the elements that make up these costs are justified, but let's assume the cost reflects an approximate estimation of the real developmental cost for the drug. The last number of $2.8 billion represents the Exubera® failure by Pfizer®. I have heard the real number is slightly over $3.0 billion. Like any other technology company, drug companies must be protected from knockoff

TABLE 1.7 Drug Developmental Costs

Year	Approximate Cost (billions of U.S. dollars)
1992	0.4
1996	0.6
2000	0.8
2003	~1.0
2007	2.8

TABLE 1.8 Patents Granted to IBM

Year	Number of Patents
1993	1,085
1997	1,724
2001	3,411
2004	3,200
2007	3,148

copies of their products. A patent gives the company 20 years to exclude others from making, using, offering to sell, selling, and importing their product. If these developmental costs are not recovered, the company will eventually go out of business and employees terminated. So intellectual property is a mechanism to capture both the costs in bringing a successful product to market and not bringing all those unsuccessful products to market.

It was mentioned earlier that patents can be licensed to generate a revenue stream. Table 1.8 records the number of patents issued to IBM®. In 2001, IBM® generated $1.5 billion from licensing their patent estates and other intellectual property. A more recent example is Kodak®. In 1975, Kodak® invented the digital camera but did not move quickly enough to commercialize the novel product. About 1,000 patents are assigned to Kodak® on digital imaging. In the last 3 years Kodak® has received between $250 and $350 million per year from licensing fees. It has been projected that the magnitude of the licensing fees will continue through 2012. For most companies this would represent a very nice profit center.

There is also a connection between intellectual property and the financial performance of a company.[7] Table 1.9 lists the rankings of several chemical and pharmaceutical companies in 2007 based on their financial performance and intellectual property. In general, pharmaceutical companies will have a smaller number of patents than chemical companies because more of their information is kept as a trade secret.

TABLE 1.9 Company Financial Performance Ranking in 2007

	Company	
Ranking	Chemical	Pharmaceutical
1	DuPont®	Wyeth®
2	BASF®	Pfizer®
3	3M®	Johnson & Johnson®
4	Rohm and Haas®	Bristol-Myers Squibb®
5	General Electric	Elan®

This connection between financial performance and intellectual property can be explored further by investors seeking a possible methodology to determine the long-term financial strength of a company. Reading and understanding the patents and patent estates of a particular company and their competitors gives some sense in the risk you will undertake by investing in a startup company or by simply purchasing their stock for your personal investment portfolio.

INFORMATION OVERLOAD AND PRIOR ART

The last time I performed used Google® to search on the keywords "intellectual property," there were about 47.5 million hits. As one can imagine, some of this information will be useful but a lot will not. If you refine your search with additional words like "copyrights as intellectual property," the number of hits will be reduced to 34.5 million; searching for "trademarks as intellectual property" will result in only 17.3 million hits using Google®.

There are many sources of information for a prior art search on science and technology to be used in a patent application. Prior art includes patents and printed publications anywhere in the world that are in the public domain. Some of these information sources are worldwide patents, scientific journals, scientific databases, company annual reports, online sources, trade journals, and books. One must remember that some patents and some scientific journals may not be in English. For the online sources, one must consider the reliability of the information because the majority of the data are not peer reviewed. If you do quote from the Internet, make sure you also have the date the information appeared. Remember, online information is updated frequently. For example, university websites, and especially faculty websites, change often.

TABLE 1.10 Nanotechnology Patents

Year	Number of Patents	Changes
1995	400	—
1998	800	Doubled since 1995 (3 years)
2000	1,600	Doubled since 1998 (2 years)
2002	5,200	More than tripled from 2000 (2 years)

In the first decade of the 21st century, the Carnegie Foundation stated that knowledge is doubling every 15 years. Scientific information, however, is doubling much faster. All we have to do is look at the field of nanotechnology. A broad definition of *nanotechnology* is difficult, but usually we are discussing nanoscale materials in the 100 nm or less range, and in particular, less than 30 nm. It is in the latter range, 30 nm or less, that quantum confinement effects show up. I will limit this definition discussion to *nanophotonics*, which deals with the interaction of light and matter on the size scale mentioned. As background, conventional laws of physics change when you get down to the molecular and atomic level size. A semiconductor can emit a broad spectrum of wavelengths of light in the bulk form when photo-excited. This is where particles of the semiconductor are large, measuring much greater than 100 nm. This same semiconductor, if it can be made in specific particle sizes between 30 nm and 5 nm, will emit different wavelengths of light than the bulk semiconductor material. It turns out the wavelength of light will shift to a higher energy or shorter wavelength with decreasing particle size. In Table 1.10, worldwide nanotechnology patents are summarized over a 7-year period. You can quickly see that when nanotechnology was first emerging as a technology area, the information described in patents doubled in just 3 years from 1995 to 1998. This is much more rapid than the general conclusion by the Carnegie Foundation of knowledge doubling every 15 years.

If we now look at the number of U.S. patents issued since 1790, we will see the overall trend of a decreasing number of years for every 1,000,000 patents issued. Table 1.11 summarizes the number of issued patents in millions. The 7,000,000th patent was issued on February 14, 2006, and assigned to DuPont®. Going from 6,000,000 to 7,000,000 patents took only 7 years. In 2009, the USPTO issued 7,500,000 patents by March 3, and I was issued U.S. patent 7,569,158 on August 4, 2009. The patent numbers increased to 7,770,000 by August 3, 2010. Based on this trend, the 8,000,000th patent should appear toward the end of 2011 or beginning of 2012. Therefore, the number of years between the 1,000,000 milestones has been reduced to 5 or 6 years.

TABLE 1.11 Issued U.S. Patents

Year	Millions of Patents	Years between Each Million
1790	0	
		121
1911	1	
		24
1935	2	
		26
1961	3	
		15
1976	4	
		15
1991	5	
		8
1999	6	
		7
2006	7	

TABLE 1.12 Increased Percent of Issued Patents to Non-U.S. Countries between 1990 and 2001

United States	Japan	Germany	Taiwan	South Korea
79.6	49.8	28.3	2,955	1,701

If one looks at the number of U.S. chemical patents issued between 1990 and 2001, the number has increased from 13,075 to 23,489 patents. More important, the percent increase for several countries filing in the United States during this time increased as well, but not uniformly. In Table 1.12, the data for four non-U.S. countries are illustrated in regard to the percent increase in the number of patents between 1990 and 2001. There was a 2,955% increase from Taiwan. Most likely each one of those inventions was also filed in the inventors' parent country, where the language is not English. Often you will find that the claim structure for a non-U.S. patent may be different than the U.S. equivalent. Last, if one looks at the percent change in published information in all scientific fields from 1990 to 2004, the Asia Pacific area has increased from 16% to 25%. The European Union has increased from 32% to 38%, but the United States has decreased from 38% to 33%. The Asia Pacific region, which includes China, South Korea, Taiwan, Japan, Singapore, and India, is growing the fastest in terms of scientific information. China is now the second-largest producer of academic scientific papers in the world. The United States is still the largest

producer. Other countries, like India and Brazil are coming on strong, with an increasing number of papers.

It now should be obvious to the intellectual property writer that information obtained through prior art searches must be worldwide and be translated into English so that an accurate assessment of the novelty of your intellectual property can be performed.

CHINA AS AN EMERGING INTELLECTUAL POWERHOUSE

Recently, the China's State Intellectual Property Office (SIPO) announced that they issued more than 580,000 patents in 2009. This number is up 41% from the previous year. In 2008, China was first in chemistry-related patent applications worldwide. In fact, from 1998 to 2008 the number of chemistry patent applications jumped from roughly 4,200 to approximately 67,000, while in the United States similar patent applications increased less dramatically from about 17,100 to approximately 41,000. For China this represents a 1495% increase, but for the United States this is only about 140% increase.

In 2007 China made nearly 40% of the world's supply of computers. China also is growing in pharmaceuticals and scientific equipment manufacture. This growth in manufacture and intellectual property, such as patents, probably stemmed from Western companies pairing up with Chinese companies to form joint ventures. During this time of the joint venture, Western companies are agreeing to share their technology or intellectual property. Presently, Western firms are taking a closer look at this model of technology transfer.

China's government spent about 1.5% of its gross domestic product in 2007 on research and development (R&D). This is a small percentage when compared to other countries, but it is expanding the spending rate by about 20% yearly, an impressive rate. The trend is also seen in China's higher level education institutions. For example, the faculty of Peking University College of Chemistry has increased the percentage of papers published in high-impact journals from about 8% to 60% over the last decade. Again, a very impressive number.

Any reader interested in intellectual property—especially patents, trade secrets, and technical know-how—must take note that the Chinese government has made a concerted long-term effort to become the dominant intellectual property player in the world. At least, this is what all this information means to me. Therefore, China should become an emerging country in which to conduct routine prior art searches.

PATENTS AS SOURCES OF TECHNOLOGY

We have seen that IBM® uses patents as a source of revenue. Many companies attempt to duplicate the IBM® concept, but most likely IBM® does it the best. The patent estate of IBM® is very large, and not all of their patents are used in their existing or new businesses. Recently, IBM® has said they were willing to give up their title of holding the most patents and have become more critical of the patent system. Besides litigation costs, my guess is that the U.S. maintenance cost for the large number of patents is astronomical. This does not take into consideration foreign filing maintenance fees. Besides IBM®, there are many other worldwide companies that obtain U.S. utility patents (Table 1.13). In fact, of the top 10 companies obtaining utility patents in the United States, 9 are foreign. Table 1.13 lists only half of these companies. These companies are consistent in generating a high number of inventions over multiple years. The reason they file patents in the United States is that their products are marketed here. Besides IBM®, I should mention, Dow Chemical®. As of the end of December 2008, it had 2,266 active U.S. patents and 9,478 active foreign patents. This represents a four to one ratio of foreign patents to U.S. patents. Therefore, one should not forget the maintenance costs for foreign patents.

Next, let's look at some of the top universities holding U.S. utility patents (Table 1.14). Several points are relevant. First, the University of California system obtained, on average, 100 patents per year between 1969 and 1999. In 2003, they were granted three times that amount! Second, universities usually have diverse patent estates. This then becomes a source of licensed technology much like IBM®. Third, universities spawn many startup companies based on the technology developed by their faculty. So if your company is looking for emerging technology, the intellectual property office at universities should be visited frequently either physically or online.

TABLE 1.13 Number of U.S. Utility Patents by Company

Company	2001	2004	2007
IBM®	3,411	3,200	3,148
Canon Kabushiki Kaisha	1,877	1,800	1,987
Samsung Electronics	1,450	1,604	2,725
Matsushita Electrical	1,440	1,934	1,941
Fujitsu®	1,166	Not determined	1,865

TABLE 1.14 Number of U.S. Utility Patents by Universities

Institution	1969–1999	2003
University of Calif. System	2,768	323
MIT	2,151	152
Stanford University	961	117
University of Wisconsin	875	87
California Institute of Technology	853	169
Johns Hopkins University	593	95
University of Minnesota	556	54

PATENTS IN FORCE WORLDWIDE

Globally there were about 6.3 million patents in force in 2007. This means that maintenance fees are being paid on a regular basis. A further breakdown has the United States with 1.8 million, Japan with 1.2 million, and the rest of the world with the balance of 3.3 million patents. Some of these patents probably have invalid claims and some infringe other valid patents. Another way to look at these numbers is that the United States has about 29% of the in-force patents, while the rest of the world has 71%. Again this demonstrates that prior art searches must be done worldwide even though many patents will be in a foreign language.

CHAPTER SUMMARY

Fourteen tables of data are presented to illustrate various facts and trends over selected periods of time to furnish background about intellectual property. You probably have more unanswered questions than answered questions at this point, but the unanswered questions will be answered in the remaining chapters. If you are already a user of intellectual property, you do not have to spend a lot of time on Chapter 1. For the beginner, this chapter sets the stage for later discussion points. Most of the subject matter in this chapter will be covered in more depth later.

ADDITIONAL READING

1. "Call China Now for Just Pennies." *Smart Money*, June 5, 2009.
2. Slater, D., and Trachtenberg, J. "Judge Halts 'Potter Lexicon' for Copyright Violations." *Wall Street Journal*, September 9, 2008, p. B11.

3. Weber, H. "Safeguarding Intellectual Property." *Morning Call*, July 10, 2006, p. A8.
4. Pollock, L. "Judge Cuts Penalty Award against Boston Scientific." *Wall Street Journal*, September 2, 2008, p. B3.
5. Cyranoski, D. "Japan Fast-Tracks Stem-Cell Patent." *Nature*, 455 (2008): 269.
6. Crovitz, L. "Why Technologists Want Fewer Patents." *Wall Street Journal*, June 15, 2009, p. A13.
7. McCoy, M. "The Patent Leader." *Chemical and Engineering News*, August 27, 2007, p. 28.

QUESTION

1. Two sections in this chapter are "Intellectual Property: Is it Important or Not" and "Why Intellectual Property Protection Is Currently Important."

a. Conduct a web search to determine if there are other proposals being considered besides patents to protect inventions or innovations.

b. Using on the information you find, discuss a plausible model for innovation not based on patents when there are incentives to bring about the innovation.