

Chronology of Successful Inventions: Featuring Inventors in Bioelectronics and Nanotechnology

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Abstract

The patents are intensely practical and real-life legal instruments which are designed to protect inventors, time, money, and effort by allowing them monopoly of the patented inventions for the term of such patents. This article aims to shed light on the basic principles of the patent and patent law in the U.S., with special emphasis on the arts of bioelectronics and nanotechnology. This article is intended to assist a prospective inventor in protecting his or her valuable contribution to the bioelectronics and nanotechnology, by enumerating common pitfalls trapping the unwary inventor time after time and then by pointing out the paths to the safe haven.

Keywords: U.S. patent, U.S. patent law, Patent attorney, Patent agent, United States Patent and Trademark Office or USPTO, Biochip, Bioelectronics, Nanotechnology

Introduction

Patents are legal mechanisms with which inventors, venture capitalists, and corporations can protect their investment in time, money, effort, and other resources expended in order to create a new contribution to technology, *i.e.*, to the “useful arts” as proclaimed by the United States Constitution¹. Patent law is a special form of the law and a legal system specifically designed to provide government enforced means and remedies to protect the inventors’ rights in their new contributions to society. In this context, the patent law protects property and is peculiarly effective in any society where private property is recognized. In short, the patents are intensely practical, real-life legal instruments.

In today’s world, technological advance is pro-

bably the single most significant factor pervading every facet of life. Therefore, the law that deals with the rational handling of property in technology is of fundamental importance to almost any one on this planet. When the patent law functions properly, it enhances the incentive to develop new technology. Nonetheless, the patent law is esoteric and exotic at best for the average person and even for those having specialized in science and engineering. This enigma is readily explained by recognizing that those trained in science and engineering have not been tutored in law. The lack of appreciation of the patent law is compounded by the fact that patentable inventions, which by all legal principles and by statutory mandate are property, simply do not conform to the lay person’s conception of the real property. In addition, effective protection of the inventions in countries other than his or her homeland is well beyond the grasp of even an educated person, for the patent law is domestic and differs from country to country.

Accordingly, this article aims to shed light on the basic principles of the patent and patent law, with special emphasis on the patent law and pertinent legal system in the United States for scientists and engineers in the arts of bioelectronics and nanotechnology. The author does not intend to preach to the readers details of legal principles and in-depth procedures in obtaining the U.S. patents. Rather, this author desires to assist a prospective inventor in protecting his or her valuable contribution to the bioelectronics and nanotechnology, by enumerating common pitfalls trapping the unwary inventor time after time and then by pointing out the paths to the safe haven.

Chronology of Novel Technology

Lucky you! One day, a lightning strikes you and imprints a new idea in your brain cells. After an incubation period of days, months or years of battling scientific and technological huddles with your instinct and knowledge, you find a way or two to materialize (*i.e.*, embody) your intangible conception in this real world (*i.e.*, reducing your invention to practice). Reckless: upon confirming that your new embodiment actually works as you have envisioned, you gather the reporters and proudly announce your novel invention to the world. Prudent: you first obtain the priority date of your novel invention by drafting a patent

application and filing it to the governmental agency such as the United States Patent and Trademark Office (*aka* the USPTO). Wise: you instead select an expert (*i.e.*, a patent agent or a patent lawyer) to represent you before the USPTO, consult the expert, and pay (or promise to pay) the expert. The expert kindly drafts a decent patent application and files it to the USPTO.

Figure 1

No pain, no gain. One U.S. dollar, *aka* a greenback, is the smallest U.S. paper currency. You would probably expend thousands and thousands of these bills for your learned expert.

In the USPTO, the patent examiner examines your application, searches for the prior art which is (purported to be) relevant to your invention, reviews your application and claims over the prior art, and mails your expert a letter (*i.e.*, an Office Action)² which states that your application is rejected due to a lack of patentability³, *e.g.*, your invention unfortunately lacks novelty (*i.e.*, your invention is already known in this world), nonobviousness (*i.e.*, your invention is obvious to one who has ordinary skill in the relevant art such as, *e.g.*, bioelectrical engineering and nanotechnology) or both. Unless you are very unlucky, your agent would successfully convince the examiner otherwise or would be more likely to bargain with the examiner at the cost of the scope of your claims as to your invention. After a few rounds of mailing back and forth, the examiner finally grants your amended claims of a narrower scope, and your expert delivers the jolly news that the USPTO grants your invention. You dearly pay your expert, typically in the range of about 10,000 to 20,000 of those of Figure 1. The USPTO assigns a new number to your patent and publishes it in its Official Gazette. You are now the official inventor and owner⁴ of your proud United

States patent.

Figure 2

A cover page of a sample U.S. Patent in bioelectronics and nanotechnology. The cover page includes information about the inventor and invention, history of patent prosecution, priority information, relevant prior art references, an abstract of the invention, and a representative figure (if applicable).

You are entitled to be the one and only one who can prevent others from making, using, or selling (*i.e.*, practice) your invention in the United States during the term of the patent⁵. The time has come to reap the profits. You have the freedom to license or sell your new technology to an interested corporation for royalty. You instead choose to set up a start-up company, produce your own merchandise, and then sell your products in the market. You now compete with Goliath, wishing to hamstring and even topple Goliath, not with slingshots but with your patented invention.

You are indeed lucky if you can follow this chronology without getting trapped into the pitfalls awaiting you in each turn of the events. For example, your invention is patented but only proved futile; you and your expert forgo the meaningful prior art search only to miss others' patents or publications which later obsolete your invention; your expert turns out to be an absolutely incompetent idiot; your expert is indeed smart but you fail to treat him fairly; your patent is challenged by a competitor as void and null, just to name a few. Although no safe haven can protect you from all these pitfalls, you can minimize your risk simply by not missing those lynchpins designed to protect your invention.

Money Talks

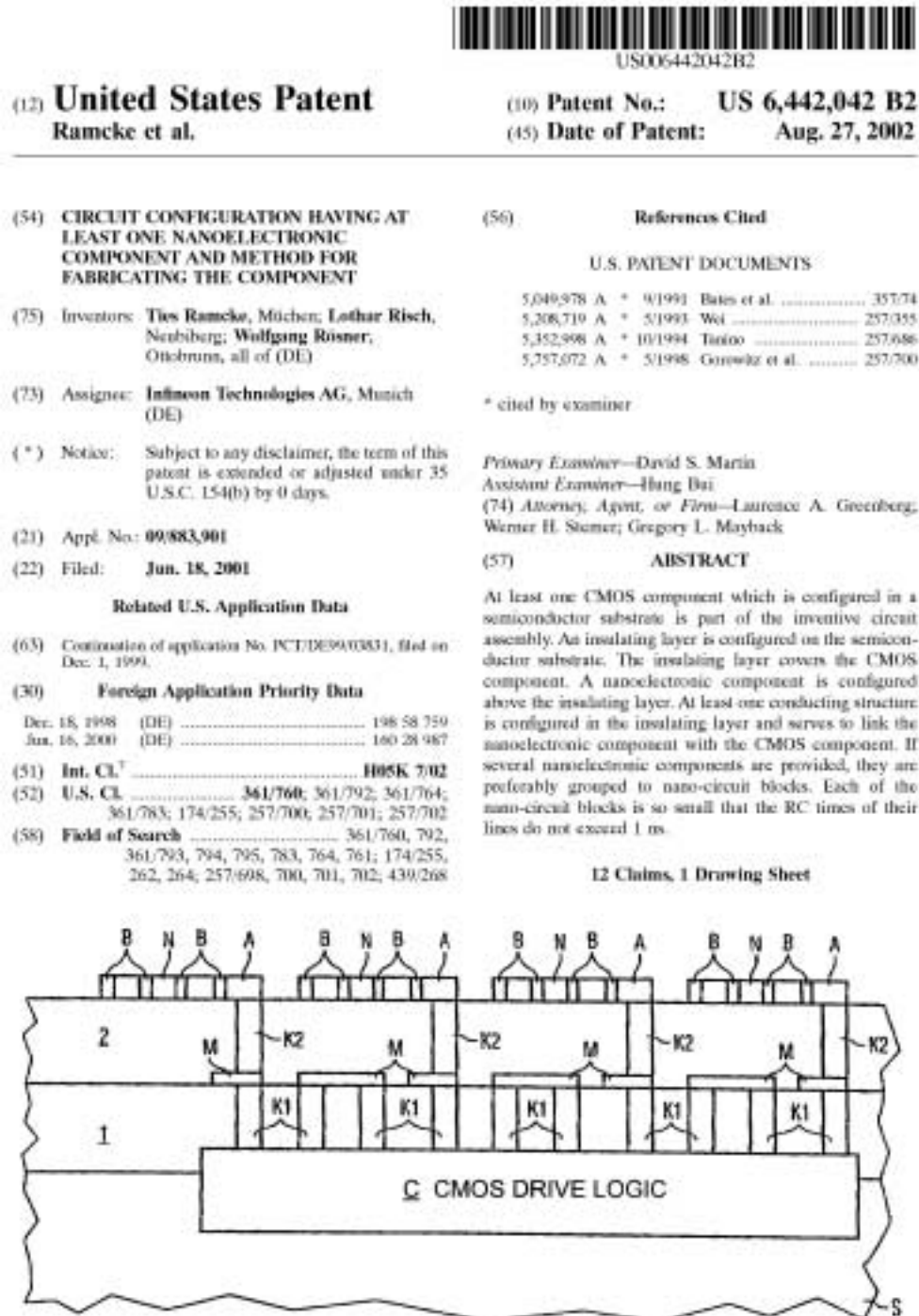
The patent industry is in general a service industry. It is, therefore, safe to say that the quality of your



Figure 1

patent application is roughly proportional to the number of bills of Figure 1 which change hands during the transaction between you and your expert who prosecutes your patent application before the USPTO. A top-notch U.S. patent law firm would typically charge you about \$10,000-\$15,000 for a simple patent application, where "simple" means that your invention is straightforward, when your invention involves

a relatively low technology, and so on. However, you may be charged \$20,000 or more if the involved technology is very complicated or high-tech or if your invention requires a voluminous patent application as is common in the field of, *e.g.*, genetic engineering. Most U.S. patent firms and attorneys charge you based on the time they spend on your application. Considering their hourly rate in the range of a few



hundred dollars per hour, the above figures delineate that patent attorneys typically spend a week or so per each application. From time to time, you may get a quotation in the range of several thousand dollars or less from smaller or boutique patent law firms or from solo practitioners. You will definitely save lots of money, probably at the cost of carrying the burden of managing the quality of the patent prosecution yourself.

You have been warned and put on notice that getting a patent costs a great deal of money and effort, albeit without any guarantee that your invention will be issued a patent and that your invention will actually bring you fame and money. However, for those of you who nonetheless strive to become successful inventors, this article attempts to identify those lynchpins in each step of the chronology of the successful inventions, to warn you of common mistakes trapping you into the deep and dark pitfalls, and then to draw your attention to those paths leading to the safe havens.

First-to-Invent System

The U.S. is a “first-to-invent” country and is alone in the world in recognizing any right of any kind being established in the inventor “at the time of invention.” In “first-to-file” countries, *i.e.*, all other countries, it is the “date of filing” the patent application, rather than the “date of invention,” which marks the beginning of potential or inchoate rights in the inventor. Thus, in the first-to-file country where the inventor invented the claimed invention five years before his or her filing date, but a prior art reference of a competitor came into existence one day prior to the inventor’s filing date (but almost five years after the inventor’s date of invention), the inventor is barred from getting a patent. This is not so in the U.S, *i.e.*, the above facts alone can not preclude the inventor, who is the last filer but the first inventor, from obtaining a valid U.S. patent. This is why the U.S. is known to have the “first-to-invent” patent system.

It is for this reason why the inventor is encouraged to diligently keep a lab note while jotting down all his or her teeny tiny thoughts thereon. Every word and phrase in the note may be ruled as the moment of conception in the future which precedes that of your competitor. Practically speaking, there is no need to worry whether those thoughts may later prove revolutionary or ludicrous. What you merely imagined yesterday may be materialized by your competitor today or tomorrow. You can then stake a claim on your competitor’s work or product.

Almost Everything is Now a Patentable Subject Matter!

In today’s world, almost everything is patentable. Just a few decades ago, you could blurt out a long list of subject matters labeled “unpatentable” by the USPTO and other patent offices throughout the world. For example, you could not obtain patents on biological organisms, substances existing in nature, computer programs, business methods, and so on. With the advent in fine chemistry, biotech, computers, and information technology, once-unpatentable subject matters are now patentable, albeit certain terms and conditions. For example, you can obtain the patents on the chemical compounds or micro-organisms by providing them in concentrations or compositions different from those existing in nature. You can protect the computer program or software, where the legal protection is reinforced if you add some hardware features to such programs. In addition, the business methods protected by the patents are omnipresent in the internet these days.

Having said that almost anything is patentable, the next legitimate question is “what criteria are used to determine patentability of your invention?” The United States Codes (or U.S.C.) answer this question, *i.e.*, the invention must be “useful”, “novel” and “nonobvious”⁶. Just like anything is patentable, anything may be presumed useful as far as it is judged novel and nonobvious. Therefore, it will be prudent to summarize basic criteria for novelty and nonobviousness, and knowledge of such novelty and nonobvious will assist you in assessing the patentability of your invention on your own.

Invention Must be Novel (Novelty Requirement)

A patent translates into government enforced monopoly of the claimed invention. Once issued, the patentee (*i.e.*, the inventor or another lawful owner) has the right to exclude others from making, using, and selling the patented invention in a specific territory. However, the patents issued to trivial inventions will obstruct commerce by imposing unfair burdens. Therefore, the legislature has set up multiple lines of defense to prevent such futile or at best marginally useful inventions from proclaiming the patent rights. The first line of defense is the novelty requirement, *i.e.*, the claimed invention has to be novel, and the second line of defense is the nonobviousness requirement of the claimed invention.

Much of Section 102 of 35 U.S.C. deals with the legislative definition of what is not novel⁷. Albeit their verbosity, its subsections (a) through (g) fall in three categories, I, II, and III, according to three

basic legal criteria that distinguish among them. As will be seen, subsections (a), (e), and (g) have a common basic legal frame of reference placing them together into category I; subsections (b) and (d) in category II; and subsections (c) and (f) into category III.

Category I is directed to the novelty of the invention as affected by others, not by the inventor. The novelty subsections of this category generally specify that if certain novelty-defeating events take place due to others prior to the date of the invention, then no patent may issue to the inventor because of such events caused by others. Such events include, *e.g.*, others' publications which describe an enabling description of the invention claimed by the inventor, the claimed invention patented by others, and public knowledge of the claimed invention or its use by others. In short, the claimed invention is not novel and not patentable if it is identically demonstrated in the prior art such as, *e.g.*, others' earlier use, others' earlier knowledge, others' earlier publications, and the like. When any of these happens, it is said that the claimed invention is anticipated by the prior art, and the claimed invention reads literally on the prior art⁸.

A second frame of reference, category II, relates to events that occur prior to a fixed period of time before the U.S. filing date of the claimed invention, where the events are attributed to the inventor himself or herself, but not to others. Under the U.S. patent statute, a critical period is one year prior to the filing date of the invention. Therefore, if certain prior art-type events, such as a printed publication by the inventor or public use or sale by the inventor came into existence more than one year prior to the filing date of the claimed invention, the inventor is absolutely barred from obtaining the patent. This is termed a "statutory (time) bar." This is so even if the inventor may have completed the invention in the U.S. years prior to the appearance of the barring event. Consider you have an invention date in 2003 and a filing date on January 3, 2007. The prior art came into existence on January 2, 2006. This is well subsequent to your date of invention, but one day earlier than the "critical date" which is one year prior to your U.S. filing date. Under category II, you are absolutely barred from obtaining a valid patent, although not barred because of category I.

The rationale behind this concept is simply that the legislature will not grant a valuable property right to the inventor who is dilatory in bringing his or her invention to the public as a published patent. In short, this statutory time bar with respect to a filing date is a goad to the inventor to get the invention processed in the USPTO promptly, with the objective of giving the

public knowledge of the invention at the earliest reasonable time. The inventor, therefore, is put on notice that, once invention takes place, there is a need to proceed promptly toward patenting the invention, for any number of barring events may develop of which the inventor may be completely unaware, but that will imperil the right to obtain a patent. In a sense, the need to rush to a patent office which exists in all countries other than the U.S., *i.e.*, in the first-to-file countries, also exists in the U.S., but in a rather modified and reasonable way. It is noted that one-year period prior to filing is granted as a "grace period"⁹.

In contrary, Category III deals with neither the time of invention nor the filing date as a primary focus. Rather, Category III is a miscellaneous category that comprehends all the residual portions of Section 102 not contained in categories I and II. For example, Section 102 (f) specifies that the inventor may not get a patent if he or she did not invent the subject matter sought to be patented.

How does Section 102 actually come into play in the USPTO? After reading through the claims of a patent application, the examiner assigned to a specific unit of relevant technology opens up his or her treasure box and picks out all potential prior art references. On identifying the most relevant prior art reference, the examiner compares each claim of the application with the reference. When he or she finds each and every element as set forth in the claim, either expressly or inherently described, in the single prior art reference, the examiner drafts an Office Action stating that the claimed invention is rejected as being anticipated by the reference. When the examiner finds another anticipating prior art reference, he or she will enlist this as the second reference in the Office Action and reject the claimed invention one more time. Words of advice should follow: do not take it personal; it is what they do and what they are trained to do. Anyway, the inventor may need at least three lives to survive the Office Action, unless the examiner is (indeed in many cases) wrong!

Invention Must be Nonobvious (Nonobviousness Requirement)

With Section 102 alone, even the futile or marginal invention may establish its novelty as long as the examiner fails to find prior art references expressly or inherently express each and every element of the claimed invention. Accordingly, the patent law provides the second line of defense to prevent a useless idea from obtaining the patent through the nonobviousness requirement. In lay person's terms, this means that the claimed invention is not patentable if the invention is an obvious modification of the prior

art or an obvious combination of multiple prior art references. In effect, Section 103 of 35 U.S.C.¹⁰ superimposes the nonobviousness requirement that the claimed invention as a whole would have been nonobvious at the time when the invention was made to a person having ordinary skill in the art to which the claimed invention pertains.

Section 103 thereby provides the legal basis in that the claimed invention is nonobvious if the modification or combination of the old elements would have been "nonobvious" to a person of ordinary skill in the art at the time the invention was made and, therefore, properly subject to the grant of patent protection. As manifest, Section 103 includes vague terms construction of which is at best subjective. Therefore, the U.S. Courts have adopted the three-part test which had been disposed by the U.S. Supreme Court decades ago in three patent cases such as, *e.g.*, *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), *Calmar & Colgate-Palmolive Co. v. Cook Chemical Co.*, *ibid.*; and *U.S. v. Adams*, 383 U.S. 39, 148 USPQ 479 (1966). Based on this trilogy, the test requires answering the following questions before nonobviousness may be decided for the claimed invention even though it is admittedly novel and useful:

(a) Is a combination of old elements present in two or more prior art references?

(b) If so, does the combination of old elements produce a "new or different function," *i.e.*, not merely a new result, but also a different or unexpected result?

(c) How much novelty, how much unexpectedness, how much difference, and how much synergism must exist in a combination of old elements as contrasted with another patentable invention which is not a combination of old elements?

If the answer to (a) is no, the claimed invention is nonobvious and, thus, patentable. When the answer to (b) is yes, the claimed invention is nonobvious and patentable as well, albeit there is a room for debate how new and different the claimed invention should be. As to (c), however, many other factors must be considered to reach the right conclusion.

In order to enhance credibility of the nonobviousness test, the patent law often seeks objective evidence by resorting to various secondary considerations such as, *e.g.*, long felt need for the claimed invention in the art, unsuccessful attempts by those skilled in the art to solve the problem, commercial success of the claimed invention, extensive licensing of the invention, prompt and immediate copying of the claimed invention, and the like¹¹. Although not conclusive, the secondary considerations can add validity to determination of nonobviousness. It is to be understood

that scientists and engineers, no matter how brilliant and creative, do not and can not create without using elements, components, materials, symbols or techniques which are known in the art and, therefore, that virtually all inventions can be deemed as modifications or combinations of old elements. Therefore, it is necessary to provide safeguards for protecting the patentable inventions from indiscriminate nonobviousness rejection.

The first safeguard requires that there must be a basis (*i.e.*, teaching) in the prior art reference for combining or modifying the prior art elements for obviousness rejection. That is, obviousness can not be established by a simple combination of old elements to produce the claimed invention, absent some teaching, suggestion or incentive supporting the combination. The mere fact that the prior art reference can be combined or modified does not render the resultant combination obvious, unless the reference also suggests the desirability of the combination.

However, the suggestion to modify the reference or combine such references to produce the claimed invention need not be expressly stated in one or all the references to show the obviousness. Rather, the test concerns whether the combined teachings of the prior art, taken as a whole, suggest the modification or combination to the person of ordinary skill in the art. If the examiner determines the claimed invention as obvious without such a showing in the prior art, it is said that the examiner has impermissibly used "hindsight" by using the inventor's teaching as a blueprint to hunt through the prior art for the claimed elements and combine them as claimed.

The second safeguard requires that the teaching, suggestion or incentive to try modification or combination of the prior art must carry with it reasonable expectation that the result can be successful without undue experimentation. Therefore, a prior art suggestion for virtually endless experimentation does not establish that the invention is obvious, because it is merely a suggestion to look for a needle in haystacks without telling which haystack is worth looking through. However, the obviousness does not require absolute predictability either; at least a reasonable expectation of success is necessary.

The third safeguard requires that modification or combination of the prior art references can not prove obviousness if an intended function of the claimed invention is destroyed thereby. Accordingly, modification or combination of the prior art reference for its own sake can not be used as the evidence of obviousness of the claimed invention, for there would no technological motivation for engaging in such modification or combination: that would actually be a dis-

incentive.

The last safeguard requires that modification or combination must be performed in the same or analogous art to support obviousness. In essence, the obviousness analysis of Section 103 requires the person having ordinary skill in the relevant art, where such a person is presumed to be versed in the art but not in nonanalogous art. Therefore, as the modification or combination requires an element from the more remote or nonanalogous art, the evidence of obviousness loses the more ground.

How does Section 103 actually come into play in the USPTO? Section 103 becomes relevant only when the claimed invention is novel and not identically disclosed or described in a single prior art reference set forth in Section 102 but when the reference suggests in some way its modification or a combination with another reference which obviously leads to the claimed invention. Accordingly, after reading through the claims, the examiner searches all potential prior art references. The examiner then determines whether the claimed invention can be obtained by modifying a single prior art reference or by combining two or more references. Upon reckoning possible modification or combination thereof, the examiner drafts an Office Action stating that the claimed invention is rejected for being obvious in view of the prior art reference. The examiner may issue the 103 rejection in conjunction with the 102 rejection or may issue multiple 103 rejections.

Additional Requirements for Biochip-related Inventions

Some fields are known to be predictive. When a coil is added to an electric circuit consisting of a resistor and a capacitor, the circuit behaves in a predictable manner which can even be guaranteed by a mathematical equation, unless the coil is defective. When a steel beam is horizontally welded to a pair of vertical parallel angles, a resulting structure can endure more weight an amount of which can be obtained by a formula. These are some reasons why those fields of electronics and mechanics fall in a predictable category within the purview of the patent law.

In contrary, some fields are notoriously unpredictable, and chemistry and biology typically fall in this category. A chemical reaction between two chemical substances may not follow the known path any more when temperature or pressure varies, when the mixture is exposed to the electromagnetic fields, and the like. No two living organisms are identical so that even two daughter cells divided from the same cell are different. In addition, there still exist many unknown mechanisms present in almost all living or-

ganisms, rendering any meaningful estimation of many behaviors almost impossible. It is well known that an element may exhibit different chemical and physical properties when it is arranged in a nanometer scale. All such factors contribute to the conclusion that the biochip field which is governed by bioelectronics and nanotechnology has to be unpredictable as well.

The unpredictable nature of the bioelectronics and nanotechnology works to your advantage but to your disadvantage as well by the same mechanism. In order for the prior art reference to serve as the 102 reference against your claimed invention, such a reference must specifically describe each element of your claimed invention. Due to such unpredictability, the composition, structure or function disclosed in the reference has to be almost identical to those included in your claimed invention to deny the novelty. In addition, the prior art reference for the 103 rejection must include the precise motivation for modification or combination which should lead to the composition, structure or function as claimed in your invention. The chance, therefore, is that it would be more difficult to find the damaging prior art in the biochip field than in the fields of mechanical and electrical engineering. By the same token, such unpredictability would require the specification and claims of your invention to be specific and precise, while limiting the patent rights constructed therefrom to a narrower scope as well.

To-do List for Successful Inventors

Having summarized the basic legal mechanisms governing the patentability in the U.S. patent system, this article will turn to each step of the chronology of the successful invention, enumerate the common pitfalls trapping the unwary inventor, and point out the lynchpins hoping that the reader will be able to obtain the best legal protection for his or her invention as permitted by law. This article also aims to assist prospective inventors in protecting their inventions in biomechanics, bioelectronics, and nanotechnology. Accordingly, this article will provide illustrations and examples focused on such art.

1. Establish Date of Invention Upon Conception

As set forth herein, the U.S. is the only country recognizing the "first-to-invent" patent system. As manifest in 35 U.S.C. Sections 102 and 103, the single most critical date in the U.S. is the "date of invention," not the date of filing the patent application. This is the reason why you should establish the date of invention as soon as possible. Once you can establish the date of invention (in fact including

the conception and reduction to practice), your only obligation is to file the patent application with due diligence. And you can beat all other inventions invented thereafter regardless of their filing dates.

You can establish your date of invention in many different ways. You can jot down your idea in the lab note on which your colleagues are supposed to sign their names and date. You can instead summarize your idea on a piece of paper and mail it to yourself with sufficient postage, where the date stamped on the envelope by the U.S. Postal Office (but probably not by Federal Express or UPS) kind of notarizes the mailing date as the date of invention. Notarizing that paper probably is not a good idea, for notarization does not have any legal effect other than proving that a specific person signed the paper. You can ask witnesses (who are preferably not your family members) to sign the paper, while making sure to include a customary sentence on each page that "I, the witness, have read and understood the foregoing invention" and to add lines for names, addresses, and phone numbers of the witnesses. As a last but foolproof resort, you can file a provisional or utility patent application, the downside of which includes time, efforts, and experience required for preparing the application or money to pay your dear expert.

As a scientist or an engineer, you are struck with tens if not hundreds of new ideas on a daily basis. Some of the ideas may be totally lame, while others may be marginally novel or innovative. The ideas which look promising today may already have been patented by others or may become obsolete by an alternative but more efficient idea in the future. The problem lies in the very fact that you have no telling which idea will be your cash cow. And you would be wise to hedge your decision simply by keeping records of your every single idea on a piece of paper and somehow couple your idea with the date, thereby establishing the date of recording your prospective invention.

2. Reduce Your Invention to Practice

Once you conceive the invention, you should find a way to embody the invention in this world, *i.e.*, you have to discover a way of materializing your intangible conception into an actual machine, apparatus, composition of matter, method, process, manufacture, or improvement thereof. It may be you who reduce your own invention into practice or you may hire another person to do so.

When you can provide a definite and permanent disclosure of the complete and operative idea, any person of ordinary skill in the pertinent art should be able to follow your disclosure and to embody your

invention into practice. However, such a person should not perform extensive research as well as experimentation to reduce your invention to practice when your disclosure is complete. As will be discussed below, the nature of an extent of such disclosure determines the inventorship of a person (other than the inventor) who actually reduces the idea into practice.

3. Shop Right: You May Not Own Your Own Invention!

You are hereby put on notice that you may be the inventor of the claimed invention but that you may not qualify as a lawful owner of your invention. Translating this in legal jargons, the title to your invention originates in you, but this title may be subject to vesting in another person or entity under a variety of circumstances. By far the most common circumstance is that you are an employee who is obligated by an express agreement or contract to assign your invention conceived during the course of your employment to your employer. In addition to providing that your employer acquires title to the invention, your employment contract will provide that you shall assign any patent application covering such invention to the employer. While the employment contract is not in and of itself an assignment of the application, a court will require you, the employed inventor, to make such an assignment based on the rights of your employer, which is commonly termed as the "shop right."

Even in the absence of an express agreement to assign the invention, the law may imply such an obligation under certain circumstances. This implied obligation is found when you are employed for the purpose of making inventions and the invention reasonably relates to the field of your employment activities. Moreover, when you are not hired to invent, but are assigned to a scientific or engineering project in which your role is to invent, state law may imply a contract to assign. Even when hired for a general purpose, an employee with the specific task of developing a device or process may also cede ownership of the invention from that task to the employer. If your case does not fit any of the above circumstances, there is a high chance that you may be the lawful owner of the invention.

Ownership of patent and invention rights as between employer and employee is contract law; therefore, each state law controls the formation and extent of the shop right. Were the federal court to be obliged to decide an employment assignment dispute, the court would apply the law of that state, and the result might be different from state to state.

Absent other provisions in the employment contract, the single most important legal issue in the shop right dispute is whether or not you made your invention during the course of your employment to your employer. If you made the invention using your employer's equipment in the business hours, you probably have to assign your invention to your employer. In contrary, had you invented your invention using your own equipment in your house during the wee hours, the state court will closely look into the relationship between your job description and the nature of your invention. Back to the basics: money talks! If you really desire to own your invention claimed by your employer, you would probably need a contract lawyer or a trial lawyer who will vouch for you in the court at the expense of thousands and thousands of those bills of Figure 1.

4. Identify Real Inventors

In many inventions there are two distinct steps: first, the conception of a general idea; second, the reduction of invention to practice which means a discovery of a way of embodying the invention in this world. It cannot be emphasized enough, however, that the threshold question in determining real inventors (or correct inventorship) is who conceived the invention. Unless a person contributes to the "conception" of the invention, he or she is not an inventor!

The conception of the invention consists in the complete performance of the mental part of the inventive act. All that remains to be accomplished in order to perfect the act or instrument belongs to the department of construction, not invention. It is, therefore, the formation in the mind of the inventor of a definite and permanent idea of the complete and operative invention as it is thereafter to be applied in practice which constitutes the conception within the meaning of the patent law. The conception is defined as a formulation of a definite and permanent idea of a complete and operative invention, where the idea must be such that it would enable a person of ordinary skill in the art to convert the idea to a tangible form without extensive and undue research or experimentation. In determining whether the idea qualifies as a conception, one must consider the attempts to construct the machine, *i.e.*, to reduce the conception of the inventor to practice.

If no significant difficulties were encountered and few, if any, deviations were made from the mental plan, the conception was probably complete, and the person responsible for the plan is the true inventor. However, if there were failures along the way, and deviations required to arrive at a successful reduction to practice, then those responsible for conceiving the

deviations may also be the inventors, either alone or jointly with those responsible for the original plan. Note that the concern is still with the person who provided the plan and the direction, rather than with the person who provided the labor to carry out the plan. In short, the reduction to practice *per se* is not the touchstone; it is who provided the idea to achieve the reduction to practice.

Keeping this in mind, you are urged to reduce the number of inventors by identifying only true inventors, while setting aside those who merely helped you and other conceivers in order to reduce your invention to practice. Including those who did not contribute to the conception may increase the chance of disputes as to the post-patent strategy.

It is worthwhile to note that incorrect inventorship may invalidate the patent in its entirety. That is, omitting the true inventor from the inventorship (*i.e.*, nonjoinder) or including a wrong person therein (*i.e.*, misjoinder) with deceptive intention may establish the ground of invalidation of the issued patent. Of course, the nonjoinder and misjoinder absent the deceptive intention can be corrected during the prosecution without invalidating the patent.

5. Check Others' Prior Art for Patentability

Either before or after establishing the date of invention, you need to at least check whether the invention will be denied patentability due to the lack of novelty or nonobviousness. With the advent of information technology, it becomes relatively easy to surf the internet for relevant prior art and, in the case of applying for the U.S. patent, the USPTO provides a powerful search engine for its millions of patents (www.uspto.gov). You may access other sites for fee or instead hire professional search firms or searchers at reasonable cost. For example, you may get a relatively comprehensive search and analysis at several hundreds of dollars. When you need more comprehensive search, they will respond to your request by widening the search range and depth, of course at an increased cost. It is appreciated that you also have to search scientific and engineering journals for the relevant prior art. It is worthwhile to note that many university professors publish their new findings in the journals but do not seek any patent protection therefor and that companies file the patent applications but hesitate to publish new findings in the journals. Therefore, any meaningful prior art search must cover both of these two distinct realms of knowledge.

Upon obtaining the potential prior art references, you have the freedom of analyzing such for yourself, relying on the analysis of the search firm, or take no action (*i.e.*, just hand them over to your expert). It is

true that you pay your expert for the patent prosecution but it is equally true that you must be at least aware of the prior art in order to confirm and manage the work of your expert to the best of your advantage.

6. Behave Yourself for Patentability

Do not shoot your own foot! In other words, do not cause any event of Section 102 (b) and (d) of 35 U.S.C. or, if you have to do, cure it by filing the patent application within the grace period of one year. Beware that other countries are not as gracious as the U.S. insofar as the grace period may be concerned. For example, many European countries and some Asian countries do not recognize any kind of grace periods at all. In other words, you are absolutely barred from filing the application once you publish your invention, sell your invention or otherwise make your invention public. Accordingly, it is always prudent to consider an option of filing the patent application whenever you are about to mail a draft article for publication or to announce the world of your proud invention.

7. Hiring Experts

Patent practitioners are omnipresent. They practice in almost every city and county and many nationwide locating services help inventors find the patent practitioners. It is a challenge, however, to find and hire the right experts.

Setting aside their hourly rates, the single most important consideration should be given to their technical background. With the advent of technology, a patent attorney well versed in one engineering discipline may be only as competent as a lay person in another field. When your invention pertains to a biochip with a novel biological compound impregnated thereon as its patentable feature, *e.g.*, a patent attorney holding a doctorate degree in computer science from MIT may at best be an underdog for the task against a patent agent with several years of work experience in the biotechnology industry after graduating a community college while majoring biology. Unless your invention features the popular science, the background of your expert would be of utmost importance to successful prosecution of your invention.

The next important consideration would be their training and track record. Due to the subjective style and nature of drafting the patent applications and their claims, the practitioners learn their drafting skills from their mentors (*i.e.*, partners), just like the servants had been trained by their masters in the medieval times. Those experts who had worked as the examiners in the USPTO are deemed to have acquired requisite training as well. If you choose the

practitioner showing off a different track record, you must carry the burden of proving their drafting and prosecution skills. Once you locate the expert with desirable background and suitable track record, it is generally not important whether your expert is a patent attorney or a patent agent¹².

In short, you are urged to shop around the patent experts, while looking into their background, track record, their clients, and hourly rates. You may also search the USPTO web site and witness the patents which they have drafted and successfully prosecuted. Remember that money talks. The only thing you can control, unless you prosecute on your own, is to make sure that your money is well spent!

8. What And How To Disclose?

However competent and skilled your expert may be, you are the inventor, and your expert does not and cannot understand your invention without your instruction. Accordingly, you have to prepare a disclosure with which your expert drafts the patent application and designs the scope of the claims.

Many scientists and engineers tend to make the incurable mistake of trying to kill two birds with a single stone. That is, they prepare manuscripts for publication, hoping they can use the manuscripts as the disclosure documents for their patent experts. This crucial and incurable mistake is attributed to their failure to comprehend disparate purposes of the manuscript and patent, *i.e.*, the former strives for accuracy, while the latter crusades for scope and coverage.

The scientific manuscript must be precise, listing every single detail of your new achievement. The manuscript must report actual experiments and results. Any extrapolation and speculation beyond the actual results and conclusions are put under the strict scrutiny. Intentional manipulation of such results is deemed as falsification of scientific truth.

In contrary, the patent must be broad for campaigning every single piece of unoccupied estate of novelty and utility. To be broad, the patent must be equipped with broad claims and comprehensive description capable of supporting the broad claims. To this end, you have to provide your expert with the disclosure outreaching the leaps and bounds of your manuscript. Followings are some but not all means of outreaching your actual accomplishments to broaden the scope of your prospective patent:

(a) broaden the range of any number you can find in your manuscript, *i.e.*, if the manuscript describes the pressure range for the desired result as 10-12 psig, instruct such a range as, *e.g.*, between 2-30 psig, between 5-20 psig or (preferably) between 10-12 psig,

but other ranges may instead be used as far as ...;

(b) broaden the samples or examples of any element, component or composition in the manuscript, *i.e.*, when you include a monitor in your claimed device, instruct that the device may include a visual output unit examples of which may include, but not limited to, a CRT, a PDP, an LCD, an OLED, and the like, where the unit may provide a black-and-white or color images, where the unit may include a curved or flat screen, and the like;

(c) include as many examples of your invention as possible, whether you have actually tested them or they are merely in your imagination (in fact, the patent law allows inclusion of hypothetical experiments and expected results);

(d) list all possible (whether ingenious or ludicrous for now) uses or applications of your invention, for each novel and nonobvious use and application guarantees another novel and nonobvious invention;

(e) imagine all possible modifications or variations of your invention and illustrate them in writing or with figures (or sketches), for each modification and variation will render others' future inventions obvious in view of your patent;

(f) imagine all possible combinations of your invention and prior art and illustrate them in writing or figures (or sketches) in order to deny nonobviousness of others' future inventions; and

(g) do whatever you can to broaden the scope of your claimed invention!

Based on this broad and comprehensive disclosure, your patent attorney reviews the prior art and drafts the claims as well as the detailed description of your invention supporting the claims. Your expert may draft the claims encompassing every single novel aspect of your invention. Alternatively, he or she may selectively draft a smaller number of claims. In the former, you have to pay more for the excess claims and you will have to divide the application into two or more applications (*i.e.*, restriction requirement), thereby covering the wider portion of the playing field but inflicted with greater financial damages. In the latter, you can optimize the narrower coverage with less monetary investment. The choice is yours and you have to consult your expert in depth, for which he or she will bill you later.

You should be aware that your patent can be granted as an apparatus patent, a method patent or a process patent. In other words, the claims can be drafted to claim an apparatus defining a novel and nonobvious structure, a method of a novel and nonobvious use or application, and a process with novel and obvious manufacturing steps. Therefore, when you conceive the novel invention, you have to search the prior

art and determine whether you have only to claim the apparatus due to the prior art crowded with others' inventions or you can claim the novel apparatus as well as related methods and processes.

You are hereby warned again that you should not expect too much from your expert other than those you have requested. For example, your disclosure may include some errors which run against scientific truth. Will your patent attorney fix those errors? The answer hinges on whether your expert can recognize such errors, and this is one of the very reasons why you should look into the technical background of your expert. Will your patent attorney include additional modification or combination of your invention or will he or she add new uses or applications of your invention? Well, this is known as "superinvention" in the U.S. Be reminded that the superinvention rarely takes place and, if it ever does, you may have to dearly reward your expert.

9. Responding to Examiner's Rejection

After a waiting period of a year or two, your expert informs you that he or she received the Office Action from the USPTO. You can bet that the Action states that your application misses some forms (*i.e.*, send additional forms with late fees), that your application fails to specify certain terms or phrases (*i.e.*, clarify the terms or phrases), that you claimed multiple inventions in a single application (*i.e.*, select only one invention in the application with an option of claiming other inventions in separate divisional applications, again with additional filing fees), or that your claims are rejected on Section 102 and/or 103. The examiners rarely grant your application in the first round and it is against their training and their instinct³. In this context, it is utmost important for you to understand that the examiners' rejections are not the end of the world. In fact, you should anticipate the rejection, for it is what they do time after time.

The rejection based on Section 102 (*i.e.*, lack of novelty) is generally very straightforward, *i.e.*, the examiner is mostly wrong but sometimes right. Note that this has nothing to do with the intellect of the examiner but largely due to a significant workload imposed on the examiner. When the examiner is wrong, it is easy to overcome the 102 rejection, simply by showing that not all elements of the claimed invention are described in the purported prior art reference. If he or she is right, however, there is not much room to maneuver, and you are in big trouble. You have to either dramatically narrow down the scope of your invention or abandon the application itself. In contrary to the 102 rejection, the rejection based on Section 103 rejection is much more diffi-

cult. Similar to that of Section 102, the examiner is mostly wrong but it is more complicated and requires experience and knowledge in patent case law to rebut the examiner's contentions.

As an inventor, you can position yourself against those rejections by taking proper preemptive actions, *i.e.*, you search the prior art and deliver seemingly relevant references to your expert before he or she drafts the application. As the inventor, you have competitive knowledge and experience in the field of your invention, and you are aware of many relevant prior art references. Therefore, you can minimize the chance of rejections on the lack of novelty or nonobviousness by searching relevant prior art articles and patents and then delivering such to your expert who can adjust the scope of the claimed invention based thereupon.

Even a lay person like you can be trained to examine the prior art and to assess the novelty of your invention. In fact, a lay person can even respond to the examiner's 102 rejection, for the novelty criteria are generally straightforward. It is remembered, however, that many lawyers and judges have extensively construed each word and phrase of Section 102 in the courts¹³. In the case of Section 103, however, proper rebuttal of the examiner's rejection is not within the grasp of the lay man in most cases. Therefore, it is prudent to not rely on novice opinions, particularly when the stake is so high, as in the case of patent litigations. Seek the expert, and pay him (or her) well. No pain, no gain!

The last thing to keep in mind is constant supervision of your expert's work and particularly in the response to the Office Action. Check with your expert and let your expert convince you when he or she has to delete the claims or to combine the claims in your original application. Cancellation and amendment of the claims dramatically change the coverage of your patent rights and you should be in constant guard against those actions.

10. Post-Patent Strategy

Once the patent has issued, you can consider various options of reaping the profits with your novel and nonobvious technology. One way is to license out your technology. The biggest huddle in this strategy is to find the licensee and to negotiate a royalty contract. Many law firms and licensing firms are now specializing in this type of technology transfer, although the downside is their agent fee or commission typically ranging from 70% to 90% of the gross royalty. Another option is to establish a start-up company and produce your own products. You may then recoup your intellectual investment as the product sales,

company's equity, and the like, although you have to actually run the company or hire lots of people. Yet another option is to sit tight and wait until somebody actually infringes and then practices your patent. You send a solemn letter to the company for royalty and initiate an infringement suit with the help from a patent litigation firm. As you can see, none of these options are as easy as they seem. But you are the proud inventor of the U.S. patent and you will find a way or two which not only suit your personal preference but also guarantee the desired monetary rewards.

Conclusions

It is totally up to you! If you feel that the above contents flow well in your brain, you must be a do-it-yourself-type person. You can hone your skill of searching the prior art references, analyzing the prior art, assessing the patentability of your invention, selecting the right expert for you, and managing the overall flow of prosecuting your patent in harmony with your expert. Practice makes it perfect and you will someday be able to master and even manipulate the chronology of the successful invention. However, if you do not feel comfortable with many "novel" concepts stockpiled throughout this article, if all such concepts are "nonobvious" to you, and/or if you think this article is completely not "useful" at all, you have a *prima facie* reason to hire a patent expert to prosecute your invention.

Whether or not you must hire the patent attorney for prosecuting your invention has nothing to do with the quality and the commercial value of your invention. You are the scientist or engineer, and you are the inventor who is ready to contribute to technology. The patent industry is there for you and assisting the inventor like yourself is the very reason for its existence. This author hereby wishes the very best for you and your inventions.

1. Article 8, Section 8 of the U.S. Constitution.
2. The first round of examination usually takes at least a year or more.
3. The examiners always reject, for they are instructed to do so. Many rumors circulate about the rule of index finger (not thumb) that the examiners reject the (independent) claim if a height (of rows) of the claim on the paper falls short of a length of an index finger of the examiner. When they grant your claims in the first round of examination, you are very lucky or extremely unfortunate. In other words, your invention may be viewed as the pioneer invention (very rare) or your expert somehow

drafts the claims of a very narrow scope (most cases).

4. See the following section, **Whose Invention Is It?**
5. The term of the U.S. patent is currently 20 (twenty) years from the date of filing the utility patent application to the USPTO. This term, however, may be extended by accounting for many factors such as dilatory examination and processing of an application by the USPTO, secrecy orders, interferences, and successful appeals as guaranteed by the Patent Term Guarantee Act of 1999. The patentee may choose to shorten the term of the patent by filing a terminal disclaimer under 37 CFR 1.321 (c). Due to these means for adjusting the term of the patent, it is sometimes dangerous to calculate the exact term of a patent solely based on the filing date.
6. Of course the USPTO demands additional criteria for patentability. One is the so-called written-description requirement which is not too stringent to meet, *i.e.*, your patent application must include a written description of your invention. Unless you hire an incompetent expert, the examiner's rejection based on this ground can easily be overcome. Another is the enabling disclosure requirement stating that a reader of your application should be able to practice your invention based upon your disclosure without performing undue experimentation. See 35 U.S.C. Section 112.
7. *35 United States Code Section 102*: Conditions for patentability; novelty and loss of right to patent. A person shall be entitled to a patent unless -
 - (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent, or
 - (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States, or
 - (c) he has abandoned the invention, or
 - (d) the invention was first patented or caused to be patented, or was the subject of an inventor's certificate, by the applicant or his legal representatives or assigns in a foreign country prior to the date of the application for patent in this country on an application for patent or inventor's certificate filed more than twelve months before the filing of the application in the United States, or
 - (e) the invention was described in -
 - (1) an application for patent, published under Section 122 (b), by another filed in the United States before the invention by the applicant for patent or
 - (2) a patent granted on an application for patent by

another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in Section 351 (a) shall have the effects for the purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language; or

(f) he did not himself invent the subject matter sought to be patented, or

(g) (1) during the course of an interference conducted under Section 135 or Section 291, another inventor involved therein establishes, to the extent permitted in Section 104, that before such person's invention thereof the invention was made by such other inventor and not abandoned, suppressed, or concealed, or

(2) before such person's invention thereof, the invention was made in this country by another inventor who had not abandoned, suppressed, or concealed it. In determining priority of invention under this subsection, there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by the other.

(Last amended in November 2002)

8. Relevant court rulings of lack of novelty according to Subsections (a), (e), and (g) of U.S.C. 102 also read: "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987); "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzulei Motor Co.*, 868 F.2d 1226, 1236, 1 USPQ2d 1913, 1920 (Fed. Cir. 1989).
9. The USPTO has a liberal view with respect to measuring the one-year grace period. When the last day of the year dated from the effective date of a category II bar event falls on a Saturday, Sunday or federal holiday in the District of Columbia, no bar arises if the application is filed on the next succeeding business day. *Ex parte Olah*, 131 USPQ 41 (POBA 1960). MPEP Section 706.02 (a). It is important to note that the statutory grace period differs from country to country. Such a period may be six months in some countries, while other countries do not tolerate any grace period. It is therefore safe to say that filing the patent application must

precede any use, disclosure or publication of the invention.

10. 35 United States Code Section 103: Conditions for patentability; non-obvious subject matter.

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in Section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

(b) and (c) *omitted*

11. A comprehensive list of the secondary considerations includes:

(a) long felt but unsatisfied need for the claimed invention while the needed implementing arts and elements had long been available;

(b) appreciation that a problem existed and what the problem was were theretofore unrecognized by those skilled in the art;

(c) substantial attempts by those skilled in the art to fill the need of (a) or to cope with the difficulties extant because of failure to understand the problem of (b);

(d) commercial success of the claimed invention causally related to the invention itself, rather than to companion factors such as advertising or attractive packaging;

(e) replacement in the industry of the prior art devices by the patented invention;

(f) prompt copying of the claimed invention by

competitors, as distinguished from their independent development thereof;

(g) acquiescence by the industry to the patent's validity by honoring the patent through taking licenses or not infringing the patent, or both;

(h) teaching away from the technical direction in which the patentee went by those skilled in the art;

(i) unexpectedness of the results of the invention to those skilled in the art; and

(j) disbelief and incredulity on the part of those skilled in the art that the patentee's approach worked.

12. All U.S. patent practitioners must be admitted to the USPTO to represent you before the USPTO, *i.e.*, they must pass the Patent Bar examination. Once a person passes the Patent Bar examination, he or she is admitted as the patent agent. When that person happens to pass a state bar examination as well, he or she is called the patent attorney.

13. Subsections (a), (e), and (g) of 35 U.S.C. 102 delineate that the claimed invention must precede the prior art of others, *i.e.*, others' prior art can beat the claimed invention when they precede the date of the claimed invention. In contrary, subsections (b) and (d) of the Section put the inventor on notice that you may lose the novelty of your claimed invention owing to your own imprudent acts, *i.e.*, even if there does not exist any 102 or 103 prior art references, your claimed invention becomes unpatentable (*i.e.*, statutorily barred) if you inadvertently disclose your invention and fail to file the patent application within the proper grace period (which differs from country to country).