A Short Course in Patents for Chemical Engineers

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This is material from a short course I present to senior-level chemical engineers on patents. The students are involved in selecting a design problem and are required to learn to use the patent literature. I've also used this for seminars with industrial R&D groups.

Chapter 1. Memos of Invention

Scientists and engineers are taught to maintain laboratory notebooks as an important first step in the invention process. They know, but often don't follow carefully, the rules of including a reasonable description of an experiment and the data, an idea with a diagram, or a possible new process or device. The lab book usually has some coffee stains that give some authenticity. The book is signed by a colleague who usually signs about 100 pages with a single date. More on this later, but this is the beginning, even if somewhat flawed, beginning of the invention process.

At a certain point, the scientist may decide to submit a "memo of invention" (MOI). This is the basic request to have a patent application filed. The form of this is quite different from company to company but the purpose is the same. Most companies have a patent committee of technical people, and at times a patent attorney and business people, who rate the MOI's. Typically the rating is 1 to 5, with 5 being for important cases for immediate attention. The rating of 1 usually means "no interest to the company"—release to the inventor. Some MOIs are not rated for various political or technical reasons, and are held for review at the next meeting.

There are some criteria for high-quality MOIs'.

First, is this something of current or potentially future business interest to the company? An MOI can get a high rating if the invention appears to be something that could affect a core business. A very small improvement in a large-scale process can be critical.

Second, the MOI should sell the invention. It should show how the invention improves the technical state of the art. It is usually very persuasive when the MOI includes unexpected effects. The classic example is the discovery of teflon; an experimental problem led to production of a polymer that wasn't just an annoying"goo" but had truly unexpected properties. Most inventions are not "bolts out of the sky" of radically new

technology, but incremental discoveries that solve a problem known to the experts in the field. Highlighting this solution is an important part of a good MOI. The MOI should also include the three keys parts required in the PTO specification: (1) a clear written description of the invention, (2) information to enable a reasonably astute colleague to practice the invention and (3) the best mode of operation. While these may be significantly revised in discussions with the patent attorney, they do provide a starting point for the patent application.

Third, the MOI should include a reasonable summary of the prior art. This gives the reviewers a warm feeling that the writer of the memo has some reasonable appreciation concerning the novelty of the invention. In many cases, the inventor knows the prior art quite well. Some arguments why the MOI isn't obvious in light of the prior art can be very helpful to a patent committee.

Fourth, the memo should have the correct administrative details such as references to lab books and the names of the inventors. Including a colleague who did not contribute to the invention raises a flag indicating possible future problems and undermines the credibility of the MOI as a legal document. An easy reason to lower the priority; someone will need to straighten out the inventors.

Now, a few things that should <u>not</u> be in the MOI.

First, the potential inventor should not express legal opinions concerning the potential invention. Attorneys are superb at sternly warning that such opinions can come back to haunt the inventor at a deposition or, more traumatically, on the witness stand.

Second, the MOI should be written in technical language and not sprinkled with legal language. The MOI should be written as a clear technical paper.

Third, the MOI should not contain proposed claims. Many inventors with some track record have a tendency to do this. They know the difference between "comprise" and "consist" and have some ideas concerning multiple dependent claims. In my opinion, it very much annoys the patent attorney to see proposed claims.. This is his area of expertise. You don't write the prescriptions at the doctor's office.

Fourth, the MOI should stand on its own for judgment. Some inventors include a section on the planned experiments to help define the invention. This often leads to the memo receiving a low rating and held for the next patent committee meeting. The MOI should be written when there is sufficient data or the concept is sufficiently complete for an evaluation.

At most companies, a highly rated MOI has been carefully "lobbied" by the inventor. This usually means assuring that the key technical people understand the invention, its significance, and are willing to support it in the meeting. The same background works well with people from the appropriate business unit. Initial contacts with the patent attorney works best when the inventor has an established relation with the patent attorney

and gives a "heads up" on which MOIs are really important, and which may be of secondary importance.

In summary, a well-written and complete MOI gets the invention process working smoothly, generates enthusiasm for everyone involved, and paves the way for a rational evaluation of the MOI in terms of the three key criteria of an invention.

Chapter 2. Patent Searching—The PTO, the Internet and More

This article proposes a novel method for patent searches that organizes both the patent and technical literature into a “Two Tree” framework to allow patent attorneys to clearly understand the state of the technology.

Everyone knows how to find the Patent Office site at www.uspto.gov, but not everyone uses this resource effectively. The “Quick Search” is the common place to start. The searcher needs to choose two key terms and this will have a major influence on what patents are found. A little knowledge of Boolean algebra helps in terms of the definition of AND, XOR, and OR. The patents can be listed chronologically or by relevance. The later term is related to the number of times the key word appears. In the language of artificial intelligence, this is a one-level-deep search, and it is the logical approach – “breath before depth”.

A refined search focuses on searching the manual of classification for the various classes and subclasses that might be relevant to the search and other key words. This is a two-level-deep search in AI terms and is aimed at finding all relevant class/subclass groups and exploring those in depth.

The PTO site is very user friendly and there are several clear books such as “Patent Searching Made Easy” by David Hitchcock. He goes through several examples showing in detail what information is enetered and what the screens should look like. Running through one of these examples is probably a better way to learn the PTO site than reading through detailed instructions.

There is the other major web site for patents, by IBM. This is now partially a for-pay site at www.delphion.com. One usually starts at the PTO site and the main advantage of the Dephion site is that it covers patents back to 1971.

There is, of course, more than using the Internet. The scientific literature often gives direction that helps in a patent search. Most major universities have first-class on-line search programs that cover all the scientific literature.

What can a patent searcher extract from the scientific literature? First, a major review orients the searcher to the technology and the state of the art. It also suggests the typical

key terms used in the technology; there is, of course, a danger that these are not the key words used by the PTO.

Second, key articles show the breath of the technology. For example, are there references to physics, aerospace, and mechanical engineering journals? This can suggest important classes/subclasses.

Third, it may identify key patents. This can provide a test that your search is picking up what the experts consider important.

Fourth, it identifies the key scientific papers. This defines the state of the science and is probably what PTO's "journeyman researcher" is expected to accept as the conventional wisdom.

Fifth, it may include information that "teaches away from the invention" which can be essential for prosecuting a patent application.

Sixth, it can be an excellent way to identify technical experts. A well-written review is a good credential.

The combination of the PTO search and the scientific literature search allows assemble of what I call "The Two Trees". One shows the key patents and those that derive from the major patents. The second show the key articles (people and organizations) and again those that are derivative. This gives an organization of the material and prepares for a discussion of the patent or patent application in terms of the previous art.

Chapter 3. The Convergence of Scientists/Engineers and Patent Attorneys

There is a convergence between these two groups for several reasons. First, a significant fraction of patent attorneys now have undergraduate and/or graduate degrees in science and engineering. Many have significant industrial or academic experience before becoming patent attorneys.

Hence, patent attorneys have become very sophisticated in understanding new technology. An attorney pursuing a patent on a recombinant DNA product now often talks the language of the scientist. Also, the Internet provides a quick method for the patent attorney to "come up to speed" on a technical issue. No longer is it necessary to spend hours going through the shelves of technical libraries. The use of search engines such as www.google.com can lead to a pleasant array of knowledge about a technical subject. Certainly, it is very easy to obtain an MSDS on a product. There are various chat groups that also can provide insights and which can allow dialogue on the technology.

Second, many scientists and engineers have become very adept at learning patent law. This is also from the large amount of information available on the Internet. A beginning source is the MPEP available at the PTO's web site. Previously, few scientists or

engineers had access to this volume. Now, it is not uncommon for an inventor to have a strong knowledge of chapter 700 on the examination of patents. The problems from the patent bar exam are available at many sites. One can study patent law on-line at a small cost. Thus, they become much more knowledgeable concerning patent law issues than in the past. For attorneys, the is the same situation that the medical world sees. A much more informed client. Also, a client with strong opinions.

This has had some positive effects. First, the patent specifications are often much better written both in terms of the legal aspects and also from a technical point. The scientist/engineer knows how to write a strong and broad description of the invention, how to provide an adequate enabling description, and the requirements of providing a "best mode" of operation. The scientist/engineer also has more knowledge than in the past of how to assemble, organize and interpret the prior art. The scientist and patent attorney are truly collaborators and the specification isn't a patchwork of two distinct viewpoints. It also improves the claims for the same reasons. Finally, the prosecution history is more detailed and scientifically clear. This can obviously be an important aspect in cases of patent infringement.

There can be dangers when these groups become to close. A major example is the patent infringement case between P&G and Kimberley-Clark over superabsorbent diapers. The details of this case are vividly summarized for the layman in "The Patent Wars" by Warshofsky. The crux of the situation is that the P&G patent attorney essentially became a scientist, having experiments done in the lab, analyzing the results, and selecting which of those to present to the patent examiner. The court did not agree with his conduct and the patent was declared invalid due to being obtained by fraudulent means. This seems like an extreme and unfortunate case. However, it is more common now for scientists and patent attorneys to consult on new experiments to support patent applications.

This convergence of scientists/engineers will continue as technology becomes more complex. Both sides must, however, clearly learn the boundaries of where their responsibility begins and ends.

Chapter 4. Patent Infringement- Effective Scientist/Attorney Teams

The question of patent infringement usually begins with the business unit and moves to discussions with the patent attorney. It is then that the scientist/engineer as an expert witness becomes part of the team.

The initial focus is the claims. First, what are the claims' advances over the prior art. Second, the claims must be compared to the potentially infringing product or process. A patent is said to be "literally infringed" if the claims exactly describe the potential infringing product or process. This is the simplest case and technical experts are of secondary importance

The complex technical and legal area is when the product/process does not exactly "read on" the claims. This introduces the concept of "Doctrine of Equivalents". For the scientist/engineer, it can be confusing since it is not based on a clear statute but on a large literature of judicial decisions. Scientists like laws.

Also, the more expert the technical expert, the more he will see everything as an equivalent. But then this is probably not the "person of ordinary skill in the art". The technical expert must step back and use a perspective in considering equivalents. This requires reasonable experience in patent cases.

Durham gives a good discussion of this doctrine for the scientist/engineer in "Patent Law Essentials". It begins with the 1853 case of *Winans v. Denmead* on the coal-carrying railroad car and traces cases up to present high-technology cases. In general, scientists and engineers will interpret the doctrine as broader than patent attorneys, but can also point out critical differences in function, which can differentiate products or processes. As an example, most scientists would disagree with the court on *Graver Tank v. Linde Air Products* (1950) in that manganese is clearly not equivalent to the claims of an "alkaline earth metal".

This area of "equivalence" is a key area where the input of a technical expert can be crucial. The expert needs to realize that he is a resource for explaining, defining and interpreting technical information for what will be a legal and not scientific decision. The scientist/engineer and attorney team works best when the technical expert understands his role in this interpretation of patent infringement.decisions based on the doctrine of equivalents.

One important technical area is the determination of whether an improvement is still an equivalent. In fact, the improvement may even be patented. Does it add anything of significance to the invention? This is often an area for a technical expert.

While the technical expert should not become involved in case law, there are several recent famous cases known to every patent lawyer which are helpful for the technical expert to understand his role. These are : *Festo Corp. v. Shokestu Kinzoka Kogko Kabushiki* and *Warner Jenkinson, Inc*. v. *Hilton Davis Chemical Co.*

Festo made big changes on the use of the prosecution history to argue equivalents. Before *Festo,* it was clear that a patentee could not recapture claim coverage, which was given up during prosecution. However, *Festo* made this far more exacting in that all equivalents were surrendered when the claim was amended. This "absolute bar" to equivalents has been recently overturned by the Supreme Court; this was important enough to generate numerous articles in The New York Times, Wall Street Journal, etc.

It does, however, affect the way technical experts and patent attorneys work together. The *Warner-Jenkinson* case (1997) laid out many of the crucial details of when and how prosecution history can be used to determine an equivalent. The case was a simple membrane filtration and the crucial issue was the pH range. Many chemists would find

that the difference in pH used (5.0) by the infringer and the value in the claims (6.0) is scientifically trivial. However, the legal issue was viewed very differently. The result being that the burden is on the patent owner to rebut the presumption that the amendment was due to reasons of patentability.

After *Festo*, it is presumed that making a narrowing amendment to a claim creates the presumption that the " Doctrine of Equivalents" cannot be applied. In the recent Supreme Court decision, it was held that making a narrowing amendment to a claim element creates the presumption that the "Doctrine of Equivalents" cannot be applied; this presumption can be rebutted with suitable arguments that the equivalent issue wasn't, in fact, surrendered. The most likely argument will be that the equivalent was unforeseeable at the time of invention. Thus, it could not have been expected that the patentee could have drafted a claim literally encompassing the alleged equivalent.. This type of argument will require input from technical experts with a perspective on the field of technology.

However, the recent Supreme Court decision does still greatly restrict the arguments based on prior art when, for any reason, the claim has been narrowed. This limits the scientifically valid and strong arguments of the technical expert.

These decisions suggest the importance of having the patent attorney draft claims, which do not need to be amended. This, in turn, requires a detailed evaluation of the prior art to draft strong claims, which are accepted without amendment. This, in light of *Festo*, gives a stronger patent against infringement. For example, the set of claims should be comprehensive enough to include many different features and components that are different from the prior art and which could be disputed as equivalents. The Supreme Court stated "the patentee, as the author of the claim language, may be expected to draft claims encompassing readily known equivalents".

The *Festo* decision also suggests that patent attorneys structure "means plus function" claims. This requires that the specification provide multiple alternatives of the means and a careful discussion of equivalents. This benefits from input of the inventor and possibly other technical experts in the field. One needs to broadly define potential equivalents in the specification

The role of the technical expert can be also be essential in areas of rapid technological change. For the expert witness, a summary of the *Texas Instruments v. U.S. Int'l Trade Comm'n* (1988) is useful background. The technical expert has knowledge of the art "at the time of the infringement" and whether that technology would have been imagined or visualized by the patentee.

This chapter concludes with an example of how the expert witness can be valuable in reviewing the patent prosecution history. First, the expert can put in clear terms what scientific evidence was presented to the patent examiner to obtain certain claims. Obviously, this information can play a major role in the interpretation of the "doctrine of equivalents" by the patent attorney.

The selected example is the interpretation of the claim in US No. 4,277,344 by *FilmTec* for a polymeric membrane formed by the reaction of a diamine and acid chloride such that there was a "plurality of uncrosslinked groups in the product". A review of the prosecution history estoppel showed that the claim was allowed because it was unexpected and unusual for such a reaction to have unreacted groups. Thus, those who made a similar product with an essentially fully cross-linked product would not literally infringe nor would they infringe under the doctrine of equivalents.

The technical expert can play an important role in the interpretation of scientific terms. This again is a tricky area where at times the scientific and legal interprations vary. Often the situation is simple where the scientific terms have been defined in the specification. But, at other times they have not. As an example, take the *FilmTec* patent '344 discussed above. What is the meaning of plurality? It is not defined in the specification; Webster's dictionary defines it as more than 1. A chemist finds that description meaningless considering the billions of reactive groups in a gram a material. The definition of "plural" is crucial to the primary claim. The expert and patent attorney must work together to address this type of issue.

The scientific expert can also be valuable in the examination of primary documents such as laboratory notebooks. The scientist/engineer will see a method of experimentation and the thinking of the inventor. The expert can also see obviously missing but logical crucial experiments or data included, which seems oddly placed. Such a review of primary documents can be crucial in a patent infringement case in terms of the patent validity. Possibly there is important data that was not presented to the examiner which would have affected the claims allowed. Or possibly, there is a problem with the inventorship. Again, discussions between the expert and the patent attorney can have an important role in shaping the strategy in a patent infringement suit.

Successful teams of scientists/engineers are those where each understands the unique expertise of the other and where this allows a working relation to develop the strongest approach in dealing with patent infringement issues.

Chapter 5. Thoughts on Classic Patents

I live in Highland Park, IL on the site of the Gray Electric Company, and the next street over is Gray Street. For intellectual property people, this is hallowed ground. Elisa Gray is famous for filing slightly after Alexander Graham Bell. Hence Bell received US patent 174,465 in 1876 and Gray made electric motors. Patent attorneys still use this case to warn researchers on the importance of the filing date.

Joseph Glidden, an Illinois farmer, received US patent 157,124 in 1874 for the invention of barbed wire. Many other patents on wire fencing previous to Glidden's had been granted. This was not high technology. There was major interference on the Glidden

application. There were 5 subsequent patent infringement suits against the Glidden patent. Despite the perceived weakness of the patent, it was a commercial success and Glidden drew royalties throughout the life of the patent. It is an interesting example even today of the importance of a patent in establishing a credible and successful business.

The South wouldn't be so populated except for the invention of Willis Carrier who received US patent 808,897 in 1906. Many people had worked on air conditioning; the literature was vast. However, it was Carrier who combined these operations into a single continuous process that combined the four critical elements of evaporation, condensation, and compression, and heat exchange. The invention was, of course, a great commercial success.

With hindsight, the process was obvious. It could be "anticipated " from the papers of Carnot in the 1800's on continuous steam engines, but no one read the French technical literature. It was "obvious" if you read the technical papers of Josiah Willard Gibbs, a major figure in thermodynamics. But, it wasn't "obvious" to the many people proposing other refrigeration schemes that missed the simplicity and efficiency of the Carrier process. It still today teaches important lessons on process patents as being potentially important inventions.

The patent to Wallace Carothers, 2,071,250, in 1937 on the invention of nylon has present-day importance in that it defined the invention approach at many major R&D centers. Carothers was hired with a first-class scientific training from the University of Illinois. He was at the frontier of the emerging science of polymers and suspected that some type of interesting polymer could probably be made by the reaction of amines and acids. His approach was systematic and was focused on inventing not on new science. He discovered that reacting hexamethyleneamine with adipic acid produced an amazing polymeric fiber. The product was called Nylon 66. The product is still important and the research approach still is a model today of effective R&D.