REDUCING THE RISK OF PATENT INFRINGEMENT

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ABSTRACT

One life-cycle issue that is often overlooked in the design process is that of intellectual property (IP). Yet the IP associated with a product is a valuable asset of the company, sometime comparable to the materials produced or the manufacturing infrastructure. In particular, this paper addresses the IP of patents, the opportunity for patent infringement, and ways to reduce the risk of getting into this situation. One poorly managed patent infringement case could cost the company millions of dollars, wiping out years of profit from production of that product. Patent infringement is a complex topic that combines design and law with many uncertainties. Designing products that do not infringe the patent rights of others is a goal that cannot be done with certainty. A primary reason is due to the uncertainty of understanding what is protected in a patent and the uncertainty of the patent infringement process. The purpose of this paper is to educate the designer on what constitutes patent infringement and explain some ways to reduce the risk of infringing the patent rights of others.

Keywords: Design for X (DfX), New product development, Design methods

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1 INTRODUCTION

Engineering design is conducted to create a product to satisfy various needs. Years ago, the ad hoc activity of engineering design was replaced by various systematic processes that translate customer need into specific product requirements and embodiment, such as that by Pahl and Beitz (1996). Efforts have also been made to move to more systematic approaches to requirements management such as that by Liu et al. (2012). Over the past few decades there has been an effort to go beyond performance requirements to include other types of requirements. Initially the focus was on manufacturing requirements (Boothroyd and Dewhurt (1988). Eventually this activity evolved into Design for X (Meerkamm, 1994) or simply Life-Cycle design where the designer attempts to optimize the design of the product to account for all life-cycle issues, not just performance and cost (Stauffer and Lieske, 2019). Life-cycle design issues are most commonly manufacture, assembly, packaging, service, inspection, environment, and so forth. For example, a product could be designed to be made of multiple parts to make it easier to package and ship while maintaining performance during use. Or a product designed with symmetric parts to make it easier to assemble.

One important life-cycle issue that is often ignored is that of intellectual property (IP). Like design content or the manufacturing process, the intellectual property associated with a product is a valuable asset that must be managed in order to have a viable business enterprise. There are legal means for documenting and protecting IP, primarily through patents, trademarks, copyrights, and mask works as well as less tangible assets such as non-disclosure agreements, supplier relationships, and employee knowledge and skills. Different mechanisms of IP can be deployed at each stage of product development based on the certainty of product definition and cost of managing the IP. Both protecting the IP associated with a product and avoiding conflict with IP rights of others are critical aspects of product design. Mindfulness of others IP rights can help avoid conflicts in the future and avoid the cost and disruption associated with litigation activity. This goal is challenging to achieve because of the variety of issues involved and unpredictability of the situation. This effort also includes many legal issues making it wise to include legal counsel in the product design process (Weed and Koopman, 2016).

Addressing IP in the product design process is an important topic for design engineers to learn as they work in industry. The topic is also broad in scope and difficult to address every detail. For the purposes of this paper the focus will be on patents. Using patent information in the design process is common and can fall into three categories according to Koh (2020). The first category is to use patents to map out design opportunities. The second category is to use patent information to establish exemplars, heuristics, or model solutions. A common approach is TRIZ (Altsuller, 1984). The third category is to identify active patents and design solutions that could infringe these patents. It is this third category where this paper is focused.

More specifically, the goal of this paper is to discuss patent infringement and how to reduce the risk of infringing the patent rights of others through the design process. Following the example above, a table could be designed to have legs that are separate from the top. While this feature may add cost and complexity to the table, the cost of packaging and shipping the table could be reduced to the point that the overall product cost to the consumer is less. This would be an example of Design for Shipping. Following the other example above, a part could be manufactured to be symmetrical. Thus, the time to properly orient the part as it is inserted into the assembly is reduced which reduces the overall product cost. This would be an example of Design for Assembly. In both of these examples, a total product cost estimate is made of the initial design. Another cost estimate is made of the modified design. Then the results are compared to note the savings achieved.

It is extremely challenging to protect against patent infringement through the design process. Most life-cycle processes are well understood and predictable. For example, in Design for Manufacture, specific stages are conducted to improve a product's manufacturability and then the cost is reanalysed to determine the gains (Miles, 1990). Patent infringement is a highly variable topic with many episodes of uncertain inputs and outputs, some of which are described below. There are no specific stages that can be employed or gains to be determined by attempting to reduce the risk associated by infringing the patent rights of another. Another challenge is that the cost of patent infringement is not a cost that will ever be realized unless someone else files a lawsuit so an additional cost may never happen. A further challenge is that the cost of dealing with a patent infringement lawsuit is never

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known until the case has concluded. The traditional Life-cycle Design approach does not work for patent infringement. The approach taken in this paper is to educate the designer on what constitutes patent infringement and ways to reduce these risks.

2 PATENTS

A patent is an authorization from the government granting the inventor a property right for a period of time. Patents are granted by individual countries. For the purposes of this paper patent processes and laws of the United States will be presented. The reader should keep in mind that there may be some differences in other countries but in general, the principles are the same. The rights granted by a patent last for 20 years in the U.S., and no one else is entitled to this authorization (USPTO1, 2022). There are different types of patents, including utility, plant, and design patents. The most common type of patent for engineering designers is the utility patent which covers inventions that function in a unique way to produce some useful function. Being useful, it must also be novel. That is, the invention described in a patent must be different in some way from all previous knowledge and inventions whether protected by a patent or not. The invention described in a patent must also not be obvious to a person of ordinary skill in the art. Patents rights are country or region specific though the laws and policies are similar.

Seeking patent protection for inventions and seeking to avoid infringement is a critical and increasingly important part of product development. Over the past decade about 600,000 utility patent applications are made to the United States Patent and Trademark Office, twice the number filed in 2000 and four times the number filed in 1990 (USPTO2). There is similar growth worldwide, from nearly a million in 1990 to around 3.5 million today (Statista, 2022). Likewise, there has been a growth of patent disputes leading to litigation filings which vary from four to six thousand annually in the US, twice the number 20 years earlier (US Courts, 2022). Finally, defending patent rights in the courts is expensive. While every situation is different, the typical cost of patent litigation was about $2,8 million USD in 2019 for small disputes (under $25 million USD) to about $4 million USD for larger cases (average litigation cost is about $2.8M for cases with <$25M risk. For cases with over $25M at risk, the cost for litigation is about $4M (Protego, 2020).

It is important to note that a patent property right gives the inventor the right to exclude others from making, using, selling, offering for sale, am importing the invention into the country. In exchange in that right the inventor provides a clear and enabling disclosure of the invention to the public for the right to exclude others from practicing the invention (Sherkow, J. 2017). Some view this arrangement as a quid quo pro. The inventor gets the property right but in doing so must divulge the invention for the benefit of society. Thus, the government is attempting two satisfy two completing objectives. Granting a patent right requires three actions (Nydegger et al., 2016). First, the inventor must provide to the public a written description of the invention so that it is clear to a person reasonably skilled in the art in that area of technology to make and use it without undue experimentation. Second, a patent specification must set forth the best mode contemplated by the inventor of carrying out the invention. These first two actions provide the benefit to society. In this way, the public learns about new technologies and can continue to push development in this area. The assumption is that if every invention were to be held in secret there would be little exchange of ideas and technological advancements would be stifled. The best mode is also important because it provides the best example of the technology to the public, enables others to learn by this example, and ensures that the inventor can practice the invention. It should be noted that what actually constitutes the best mode is up to the inventor. However, if a product is introduced to the market and an associated patent describes a different best mode, it brings into question if the best mode has actually been disclosed. The third and final action is that the inventor must include one or more claims that fully describe what the inventor regards as the invention. This disclosure is in particular from which the inventor wants to exclude others.

The logic of the patent process is that it gives the inventor the opportunity to benefit from the invention and the ability to put it onto the market without someone else just copying the invention and reaping the benefits without the work of invention. Others also have the opportunity to enter into a licensing agreement with the patentee so that they can again reap the benefits of invention and disclosure. The intent is to be a win-win situation. Some have argued that the patent process stifles

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competition. That granting a patent right forces the competition to pursue alternatives in order to avoid infringement and thus introduce inferior products to the market (Kitch, 2000). This situation can create an economic monopoly that constrains further development. However, others have argued the opposite that the logic of the patent system holds true and have empirical studies to back up this claim (Katznelson and Howells, 2021; Galetovic et al., 2015). While this argument continues, and it may depend on the individual case, it is the system we have and product designers need to operate within it. Note, a patent is not the right to make, use, etc. but the right to exclude others from doing so. Therefore, the inventor must enforce this property right for the patent to have value. This fact adds a significant level of complexity when designing to avoid infringement. Patent rights can be lost if it is later shown that the patent does not adequately describe how to build and use the invention, incorrectly describes the invention, or contains inadequate claims. Rights can also be lost if prior art demonstrates that the invention is not novel or it would have been obvious to a person of ordinary skill in the particular area of technology.

A patent is comprised of two main parts: the specification and the claims. The specification is a description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains to make and use it. The patent specification discloses how to build and use the invention. It must describe the invention such that someone of ordinary skill in the art would know how to build and use the invention without further inventive activity. The specification must also describe the preferred embodiment of building and using the invention. The specification may also put forth additional or alternate embodiments in addition to the preferred embodiment. Further, the specification typically contains drawings of each of the disclosed embodiments that are described in the specification. It also contains a description of prior art that provides context for understanding and clearly points out the particular problem prior art attempted to address and how the invention is unique in its solution.

The claims should particularly point out and distinctly claim the subject matter which the applicant regards as the invention. They describe the scope or limitations of the invention. They provide a "boundary" whereby no one may legally build, use, or sell an invention that has all the elements in at least one of the claims of the patent. Terms used in the claims are given the meaning that they would have to a person of ordinary skill in the art at the time the patent was filed.

2.1 Understanding patent claims

The claims listed in a patent define the extent to which the patent owner can exclude others from making, using, selling, offering to sell or importing the invention until the patent protection ends. The words used in the claims are to be given the ordinary and customary meaning that they would have to a person of ordinary skill in the art at the time the patent application was filed. This point is critical for what the words mean to a lay person or an attorney do not matter when it comes to understanding the true meaning of a patent. The meaning of the words of the claim must be viewed from the point of view of the kind of person that would be expected to come up with the invention. For most consumer products for example, a person of ordinary skill could be someone with a bachelor degree in engineering. The technology would have to be very complex to require someone with an advanced degree. It would also likely require a few years of practical work experience but likely not more. Once a patent is granted and published it does not matter what the inventor(s) themselves thinks the words mean. They must be viewed from the point of view of this fictious person of ordinary skill in the art.

Furthermore, claims may be written in independent form or dependent form. An independent claim stands by itself, not incorporating a limitation from any other claim. A dependent claim incorporates all the limitations of the claim upon which it depends and adds one or more further limitations. Dependent claims may also depend upon other dependent claims creating a hierarchy of cascading limitations. A claim is written to disclose one or more elements of inventiveness. Each element could be a single word or more likely a collection of words. Each element represents a limitation of scope of the invention. The words of the claim are read element by element to fully describe what is protected.

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3 DESIGN TO AVOID PATENT INFRINGEMENT

3.1 What is patent infringement?

A device infringes on a patent if it physically has all the elements contained in one of the claims. Infringement is both a legal matter and one of design. The burden of infringement is upon the patent owner to prove that a patent claim is infringed by a preponderance of evidence. The claims of the patent define the scope or boundaries of inventiveness that are protected by the patent and only the claims can be infringed. For example, if a claim contains three elements of inventiveness, the defendant's device must contain all three elements in order to be considered to be infringing. If the device contains only two of the three, let's say, then it is not considered to be infringing on the patent. Furthermore, a dependent claim cannot be infringed upon unless all of the elements of the independent claim are infringed.

Determining if a patent claim has been infringed involves a two-step process. First the claim needs to be construed to determine its meaning. That is the meaning of the words need to be provided so that the scope of the claim is understood. (This step is discussed in more detail below). Second, the claim needs to be compared, element by element, to the accused product to identify the structure that meets every limitation of the claim. Infringement can be either direct or indirect. In direct infringement the patent holder must prove that the accused product has the corresponding structure described by every limitation of the patent claim in question. The emphasis is on the word every. By missing just one limitation of the claim in question, the patent holder will fail to prove infringement and thereby fail to exclude the accused product from being in the marketplace. Even though a limitation in the claim may not be found in an accused product exactly, it could be found by a substantial equivalent through a process known as doctrine of equivalents. Substantial equivalents may be found where the accused and claimed structures perform substantially the same function, in substantially the same way, to achieve substantially the same result. The doctrine of equivalents allows the patentee to claim those insubstantial alterations that were not captured in drafting the original patent claims, but which could be created through trivial changes. To infringe a claim under the doctrine of equivalents, an accused device must include an equivalent for each literally absent claim limitation. Finally, a patent claim may also be found to infringe indirectly but this is a unique situation involving a third party (Weed and Koopman, 2016). Because of its rarity it will not be covered in this paper.

3.2 The uncertainty of patent infringement

Determining if one's product design infringes on the patent rights of another is not always clearly understood. There is no guarantee that a particular design approach to avoid infringement will be successful. While strategies for reducing the risk are discussed below, the reality is that every organization that sells a product is at some risk of infringing someone else's patent protection, even if their product has its own associated patent(s). For example, company A designs a new product or change in an existing product, is granted one or more patents that cover that product, and introduces it to the marketplace. It could be one year or ten years afterwards they could get a letter from company B claiming that they have a patent that is being infringed and propose that company A license their technology. In this situation the companies usually negotiate a resolution. This resolution could result in company A receiving royalty payments from company B, but this result often fails because of the long-term costs and sometimes company pride. Alternatively, no resolution is made, litigation follows, company A's patent is invalidated, receives no royalty payments, and must pay all litigation costs. Usually, the resolution will be somewhere in between. However, the only place that infringement is determined is in the courts and the only way to know that one is not infringing on another's patent rights outside of court is if they are never accused of doing so.

To add further uncertainty to the process, a patent can be found valid and infringing in one lawsuit regarding the manufacture of a product and invalid and therefore not infringing in another lawsuit to prevent importing the product into the country which runs through a different court system (Tietz, 2018). Exerting and defending patent litigation is a costly and uncertain process.

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4 THE UNCERTAINTY OF CLAIM CONSTRUCTION

Engineers are comfortable with exactness. Products are designed to exact specifications and analyzed with mathematical equations. Words are not exact. As a matter of law, the words in a patent are to be given their ordinary and customary meaning to a person of ordinary skill in the art at the time the patent was filed. This last condition can be important in areas of technology that are rapidly changing. Yet the precise understanding of a claim is up to the meaning of the words and their meaning is up for interpretation (Weed and Koopman, 2016). This uncertainty is due in part to the complexity of technology, the ambiguity of language, the changing meaning of technology and words over time, and the sometime subtle idiosyncrasies of patent law (Tietz, 2018).

This uncertainty of the meaning of words in a patent is especially important during a lawsuit regarding patent infringement. Litigation in the courts is an adversarial process. Both parties in a patent litigation lawsuit attempt to interpret the meaning of the claims in a way that best suits their particular side. The plaintiff (owner of the patent) promotes meaning so that their patent remains valid and the other side infringes. The defendant (accused patent infringer) promotes meaning such that the patent is no longer valid and they do not infringe. In understanding the meaning of a claim, the words should be given their ordinary and customary meaning. One would think this process is straightforward. However, during a lawsuit conflict arises and both sides interpret words differently.

For example, a claim includes the phrase "in close proximity to …" when describing the location of one member to another. But how close do two members need to be to be "in close proximity to" each other? Both sides will argue different interpretations that support their side in the case. Litigation cases are often won or lost based on the meaning of a single word or phrase. Ultimately it will be up to the courts to provide a meaning that both sides must use. This task is known as claim construction.

4.1 The practice of claim construction

The meaning of a claim is based on the words of the claim which are to be construed from the perspective of a person of ordinary skill in the art at the time the patent was filed. This understanding should be based primarily on intrinsic evidence. Examples of intrinsic evidence are the patent and the file history that was developed during the approval process for the patent. Of secondary use is extrinsic evidence such as meanings found in a dictionary or provided by an outside technical expert. This priority of evidence was established from a landmark patent infringement case of Phillips vs. AWH Corporation to remove some of the ambiguity of claim interpretation (Mirzale and Henderson, 2005).

Intrinsic evidence for understanding the claims first comes from the claim language itself. If a word is understood in a particular way in one claim, its meaning should be the same in the other claims. Each claim must add one or more additional limitations to the invention than the other claims. This fact can also play a role in constructing the meaning of a particular word or phrase. The specification is a critical form of intrinsic evidence for it describes the invention in a way that someone else can practice that invention and provides one or more embodiments of what is claimed in the patent. Therefore, the construction of a term should be consistent with how it is used in the specification. Patent drawings can also reveal meaning of the claim language within proper context. Typically the drawings in a patent depict one or more embodiments of the invention. In a utility patent, what is claimed is almost always broader than any one example of the invention. It is easy to become fixated on the drawings and have too narrow of a view of the invention (Koh, 2020). Finally, the file history provides intrinsic evidence for claim construction. The file history (often referred to as the prosecution history) documents the exchange of information between the patent applicant and the patent examiner. This exchange is usually a negotiation which ends in reducing the scope of a claim in order to get it approved and can sometime provide evidence on what is meant by a word or phrase in the claim language.

Extrinsic evidence for understanding the claims secondarily comes sources beyond the patent or file history. Extrinsic evidence should only be used when the intrinsic evidence is insufficient to provide a clear understanding of the claim language. Examples of extrinsic evidence are dictionaries, testimony of a technical expert, prior art patents, technical or industry publications, and testimony of the

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inventor. Of note is that litigation may happen years after the patent is filed. So it is critical that extrinsic evidence promote meaning at the time of filing, not litigation. For example, the term "computer system" has had an evolving meaning over the past few decades.
When construing the claim an opinion from the inventor after the fact plays no more important role in claim construction than any other form of extrinsic evidence. The patent itself becomes the sole description of the invention regardless if the inventor meant something different than the court's claim construction. This fact presents additional uncertainty if later the inventor attempts to assert patent rights against another manufacturer but a claim limitation gets viewed in a way that is different than what the inventor intended.
There is also uncertainty with the results of claim construction. In the claim construction process, typically the plaintiff provides one construction and the defendant another, each to the benefit of their side. The court then picks one of the construction or provides its own construction, typically somewhere in between the two. For example, the term "input device" could be construed to be "a device that sends signals to a computer". This construction is more detailed but can still be viewed differently by both sides since again, the construction is still words.

5 REDUCING UNCERTAINTY AND RISK

There is no way to make sure a design does not infringe another's patent claim or get accused of such. No matter how diligent one is to understand relevant patents and design a product that they believe avoids infringement they may still be found to infringe at some point in the future. In this paper some of the most important legal principles and strategies have been presented so that the reader can see the complexity and uncertainties associated with this situation. Yet these strategies can be employed to help reduce this risk.

5.1 Design-around strategies

As markets and customer expectations evolve over time, companies must respond. Therefore, competing companies usually are pushing technology in the same areas which can lead to patent infringement. There are a few strategies that the designer can employ to avoid infringement, the most commonly applied are known as "design-around" strategies. Design around strategies are well documented in the literature (Ubell, 2006). The timing of employing a design around strategy can vary. It might take place before expected litigation or while litigation is taking place (Ubell, 2006). Regardless of the timing, the design-around approach can provide some reduction of risk for patent litigation.
There are a variety of approaches to conducting a design-around process in order to avoid infringement. provides a detailed, multi-step process that serves as a good example. It starts with determining the meaning and scope of a claim. Then it provides for multiple steps to compare the accused structure, element by element, to the claim. Nydegger, (2016) provides another good example of a design-around strategy that is somewhat more detailed from a legal perspective, citing many examples of case law. Again, the goal is to provide an alternative approach that does not infringe.
One key step in any design-around approach is to eliminate at least one element of an independent claim from the alternative design. This approach can be successful at avoiding infringement because the conflict is simply not there. Recall that a claim is comprised of one or more elements that describe the invention and provide for the scope of protection. If the design-around product has no structure that is called for in one of the elements of the claim, then it will not infringe. Another reason this approach is effective is that often times, inventors are forces to limit a claim in order to gain approval over prior art. This situation can be found by reviewing the file history and reading the correspondence back and forth between the patent applicant and patent examiner. Many patents' applications are rejected at first because they every element of a claim can be found in or is obvious because of prior art. Patent applicants will add an element that further limits the scope of their patent in order to gain approval but that additional limitation may not be needed in order for the invention to work well.

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Another key step is to find a substitute component if none of the claim elements can be eliminated. This approach is risky because the resulting product may still infringe even if the designer intended it not to infringe. The exact meaning of the words, and therefore the meaning of a claim element, are not truly defined until claim construction. One designer may have the opinion that a substitute component does not infringe a patent claim and another designer may have the opinion that it does or that the difference is not sufficient.

Even if a product does not have a literal match on all of the elements it still may infringe if it is viewed to not be substantially different. But what makes a difference substantial? An often-used process is to apply the doctrine of equivalents discussed above. Substantial equivalents may be found where the accused and claimed structures perform substantially the same function, in substantially the same way, to achieve substantially the same result. There are other means for determining equivalents that can be used in litigation that are important to attorneys. But for the engineer the most important understanding here is that their product will be compared element by element in a claim to determine if it matches the claim limitation explicitly or by not being substantially different.

Finally, the design-around project should be matched with a written detailed opinion from both a technical and legal perspective that the effort was successful. This document will demonstrate that a good faith effort was made, legal opinion was sought, and the process was taken seriously.

There are benefits with the design-around approach. One is that a product can get introduced to market with alternative technology and compete without infringing another's patent right, thus avoiding all of the problems associated with infringement litigation mentioned above. Another is that pursuing a design-around project demonstrates good faith in respecting the patent rights of another and attempting to find an alternative approach. This fact can lessen the change of being found of wilful infringement and reduce damage awards if litigation does follow. It could even encourage a negotiating settlement because it would strengthen the position of the defendant.

There are problems however, with the design-around approach. One is that the approach assumes the patent search is complete. This is a necessary assumption but one that does not always hold true. Patent searches typically depend on key words and search budgets are often limited by time and money. Patent authors are notorious for using many words that mean essentially the same thing. Think of the terms "next to", "in proximity to", "near to", "in the presence of". The patent author is free to use his/her own lexicon and define the invention in the way they believe is best. Compounding this situation is that some patent authors attempt to use words with meaning that are confusing or vague to provide for the broadest patent protection. Therefore, it is possible that a patent will be missed.

Another problem is that the design-around strategy depends on the potential infringer to make decisions on the meaning of the claims and assess that their alternative design avoids infringement. Problems of construing terms in a claim and claim construction have been discussed above. One really never knows if their interpretation of the meaning is correct and would hold up in court if litigation results. Words are imprecise and there will always be uncertainty with regard to infringement with the design-around solution.

5.2 Work with an attorney

If an accusation of infringement is received, it is the engineer's responsibility to seek the help of the company's counsel or hire an outside attorney. There are several reasons for this action. Patent litigation is a complex situation and combines design and law. Engineers know product design in more detail than patent law. Few receive adequate education in patent law and can inadvertently design infringing products. This typically happens because they are either not aware of a patent, do not know how to understand a patent, or do not understand the nuances of patent law. Another reason to secure the assistance of an attorney is that seeking legal assistance, especially when producing a legal opinion of non-infringement or a design-around project should lessen the potential damages of litigation if found guilty. Following, the client must also respond to the opinion and act on it where necessary. Unfortunately, there is no test to determine if the engineer has adequately responded to the legal opinion but there should be some type of written response and documentation of action to the opinion. If a legal opinion is produced but not acted upon it is as if it never occurred. There is then the potential for wilful infringement and larger damage penalties because the design showed disregard to legal advice.

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6 SUMMARY

Patent infringement is a complex topic that combines design and law with many uncertainties. There is much subjectivity involved in understanding what is protected in a patent. Several people can read a patent and have as many opinions as to what is claimed. Likewise, two people can compare a product to each element in a patent and have opposing opinions of infringement. There is no way to make design changes and calculate a decrease in possible infringement as with many other life-cycle issues. As provided in this paper there are many instances of uncertainty related to patent infringement. It may seem that the situation is hopeless and that there is always risk of patent infringement whenever a product is introduced to the market. In reality, this is true, but not hopeless. The approach taken in this paper has been to educate the designer on what constitutes patent infringement and explain some ways to reduce the risk of infringing the patent rights of others.

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