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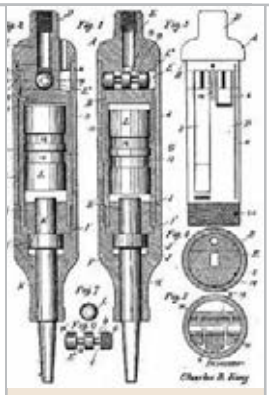

DON'T JUST COVER THE ENGINEERING DESIGN PROCESS, patent it!

BY
PHILIP A. REED

"Learning about [intellectual property] can help students understand the process it takes to bring ideas to fruition.

When you discuss the concepts of invention and innovation with students, you inevitably get excited responses that start "One time, I had this idea…". Students are very eager to talk about inventions and innovations because discussions and activities surrounding the inventive process often have personal meaning and allow them to use their imaginations to be creative. It is very important for technology and engineering students to learn early that technology is not just concrete processes and physical artifacts. Creativity is closely linked to technology and is vital in helping us address perceived needs and wants (ITEA/ITEEA, 2000/2002/2007).

A second important topic when discussing invention and innovation is the concept of intellectual property (IP). IP is defined as "creations of the mind—creative works or ideas embodied in a form that can be shared or can enable others to recreate, emulate, or manufacture them" (United States Patent and Trademark Office, 2012a). There are established procedures in the United States and most countries that individuals and companies can use to protect their IP. Learning about IP can help students understand the process it takes to bring ideas to fruition.

INTELLECTUAL PROPERTY CLASSIFICATIONS

The four most common ways to protect intellectual property are trademarks, service marks, copyrights, and patents. Each of these classifications provides protection for a certain type of intellectual property, and they vary in the time period and depth of coverage.

Trademarks protect words, names, symbols, sounds, or colors and distinguish a proprietor's goods from those manufactured or sold by others. For example, the Coca-Cola® Company has a trademark on any product that uses the terms Coca-Cola® or Coke®. Service marks provide the same protection as trademarks except they are for services, not products. Trademarks and service marks are often referred to simply as "trademark" or "mark." The designations TM and SM may be used to lay mark on a product or service even if you have not filed with the United States Patent and Trademark Office (USPTO). However, the registration symbol (®) may only be used after the USPTO officially registers a mark.

Copyrights, on the other hand, protect original works of authorship, including literary, dramatic, musical, artistic, and certain other intellectual works, both published and unpublished. A copyright gives the owner the right to perform, reproduce, and distribute their work. Derivative works, such as the second book or movie in a series, are also covered by copyrights (United States Patent and Trademark Office, 2012a).

The designation for a copyright is usually the word "Copyright" or the symbol "©" placed on a document followed by the year of publication and author's name. The Copyright Office of the Library of Congress registers copyrights. Authors do not

have to register their copyright but doing so provides the following benefits:

- Establishes a public record.
- Registration is necessary before engaging in infringement lawsuits.
- If made within three months, the holder can claim legal fees as well as damages.
- Allows registration with the U.S. Customs service to protect against imports (United States Patent and Trademark Office, 2012a).

Copyrights are held for the author's life plus seventy years. The seventy years added to an author's lifespan is designed to protect estates and corporations from infringement. Materials that are not copyrighted are in the public domain and may be used and distributed freely. Classical music from Beethoven, Bach, and other master composers is a good example of public domain material. School bands and orchestras often perform these works, not only because they are beautiful but also because the sheet music is readily available and relatively inexpensive when compared to copyrighted works. Keep in mind, however, that once a performer records a work that is in the public domain, that performance is now protected under copyright law. Teaching students these details is vital in order for them to fully understand intellectual property.

Patents are the most recognizable form of IP because of the protections they offer inventors and the romanticized view that they are the foundation of an economy based on capitalism. After all, they provide the legal protection for the products consumers need and want. Patents are issued by the U.S. Patent and Trademark Office "to exclude others from making, using, offering for sale, or selling the invention in the United States or importing the invention into the United States" (United States Patent and Trademark Office, 2012a). Despite these protections, a patent is not a guarantee of fame and fortune. In fact, most patented ideas are never even brought to market, and many that are commercialized end up with less-than-expected results. Nevertheless, the allure of inventing something that may be patentworthy is a natural hook that excites technology and engineering students.

INVENTIVE PROCESS

The inventive process is highly path-dependent (Schwartz, 2004). An inventor must clearly understand the problem and know if similar ideas exist. If there are existing ideas, they may not solve the same exact problem, or they may have deficiencies that can be overcome with a new design. Such social, economic, and contextual issues are vital for understanding the inventive process (Petroski, 1997). These issues are often covered in varying degrees by other disciplines when they discuss technological design and the interactions of technology and society (Foster, 2005). *Standards for Technological Literacy: Content for the Study of Technology/STL* (ITEA/ITEEA, 2000/2002/2007) has stronger connections to the inventive process and requires technology and engineering educators to go deeper into the topic in order to increase the technological literacy of their students.

The design process is one of the core concepts of technology (*STL*, p. 33), and the sharing of technological knowledge through the patent process is a part of the nature of technology (*STL*, p. 52). Additionally, technology and engineering teachers have used the design process as outlined in *STL* Standard Eight, Benchmark H (p. 97) to engage students in a variety of design and problem-solving activities. Some of these activities are "formal" because they are cocurricular and meet class objectives (i.e., Technology Student Association [TSA] events). Additionally, "informal" technological activities often use the design process in extracurricular activities. Figure 1 illustrates the engineering design process recommended by NASA for the Plant Growth Engineering Design Challenge, which is an example of an informal (extracurricular) activity.

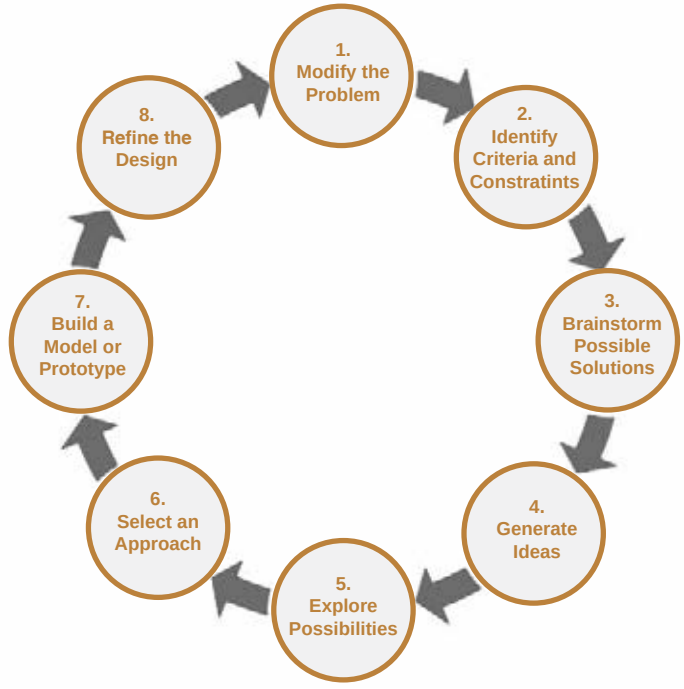

Figure 1: The Engineering Design Process (NASA, 2012).

A natural extension of the engineering design process is the process for obtaining a patent. Students who use *STL* Standard Eight, Benchmark H (p. 97) to document their work can use this information to understand the patent application process. Figure 2 is an algorithm of the application process for a utility patent. Engineering design documentation can be helpful for students to understand the details of Steps 1-6. If properly documented, students can determine specific features and elements of a potential invention, perform a novelty search, and evaluate the potential invention in light of their novelty search. Such an activity reinforces the need for clear engineering design documentation and deepens students' understanding of intellectual property. The classroom activities that follow can also strengthen these connections.

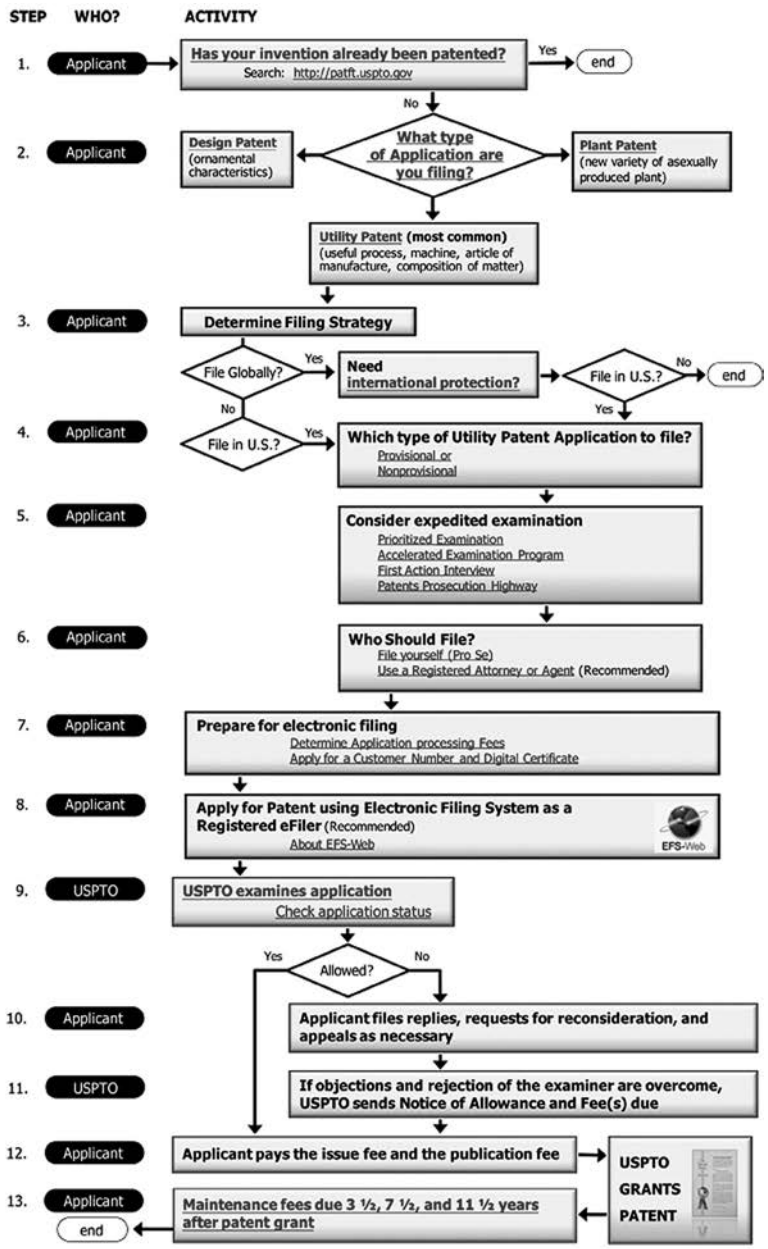

Figure 2: Process for Obtaining a Utility Patent (U.S. Patent and Trademark Office, 2012b).

CLASSROOM CONNECTIONS

Activity 1: Learn the nomenclature of a patent.

There is a lot of information and legal jargon in a patent. Understanding how a patent is organized can help students conduct a novelty search and ultimately determine if an idea is original. Particular areas to focus on are the U.S. Classification (U.S. Cl.), Field of Classification Search, References Cited, and Other Publications. Understanding these sections will refine student search skills. Additionally, terms such as inventor, assignee, and claims should be explained so students understand exactly who has been granted the patent and what specifically is covered.

Activity 2: Search for a famous patent.

Conducting a simple (e.g., novelty) search can be accomplished on the U.S. Patent and Trademark website (www.uspto.gov/patents/process/search/index.jsp) and is similar to using an Internet search engine. Like an Internet search, however, students can get frustrated if they do not have some direction. Understanding patent classifications and creating a list of key words can focus a search. Have students research a famous patent or inventor using key words and patent classifications. For example, have them look up the Wright brothers' patent (#821393) that was issued on May 22, 1906. To do this, have them go to the link above and scroll down to the section titled Searching TIFF Image Patents (Since 1790). When students select View Patent Full-Page Images and enter the Wright brothers' patent number, they will be able to view the original patent. Have them compare that to a contemporary patent. They should notice that patents have become much more detailed, even for objects far less complex than an airplane.

Activity 3: Conduct a patent search for an original idea.

After students learn the nomenclature of a patent and how to conduct a novelty search, have them conduct a patent search for an engineering design solution that they have created. The U.S. Patent and Trademark Office recommends this seven-step process for conducting a search:

1. Brainstorm keywords related to the purpose, use, and composition of the invention.
2. Look up the words in the Index to the U.S. Patent Classification to find potential class/subclasses.
3. Verify the relevancy of the class/subclasses by using the Classification Schedule in the Manual of Classification.
4. Read the Classification Definitions to verify the scope of the subclasses and note "see also" references.
5. Search the Issued Patents and the Published Applications databases by "Current U.S. Classification" and access full-text patents and published applications.
6. Review the claims, specifications, and drawings of documents retrieved for relevancy.
7. Check all references and note the "U.S. Cl." and "Field of Search" areas for additional class/subclasses to search (USPTO, 2012c).

Conducting a search will expose students to similar ideas and will require them to review their own design. Additionally, conducting a search and refining their idea will be insightful for students if they are developing a business plan or marketing materials.

Activity 4: Create patent drawings.

Patent drawings may use orthographic, elevation, section, or isometric techniques to represent the details of an object. Figure 3 shows a patent drawing that uses isometric techniques. Review some examples with students and note that there are no projection lines or center lines and that conventional measurement techniques are typically not used. Instead, Latin numerals with leaders are used for notes that pertain to scale and dimensions. Have students use these conventions for their drawings of an engineering design solution. More information on drawing requirements can be found in the Nonprovisional (Utility) Patent Application Filing Guide (USPTO, 2012d): www.uspto.gov/patents/resources/types/utility.jsp#heading-23.

Activity 5: Create a business plan.

The engineering design process focuses on solving a problem, and the patent process provides protection to novel ideas. Manufacturing and marketing an idea is a very different process. Inventors are often good at defining and solving problems, but they must also understand how to bring their ideas to market. A business plan can help identify consumers, outline manufacturing and distribution issues, and lay the foundation for marketing materials, among other details. However, researchers have found that many inventors often have trouble taking the technical details of their ideas (i.e., patented claims) and writing them up into benefits that consumers will understand (Merwyn Business Simulation, 2012). A business plan can help take students from the engineering design process to the marketplace by

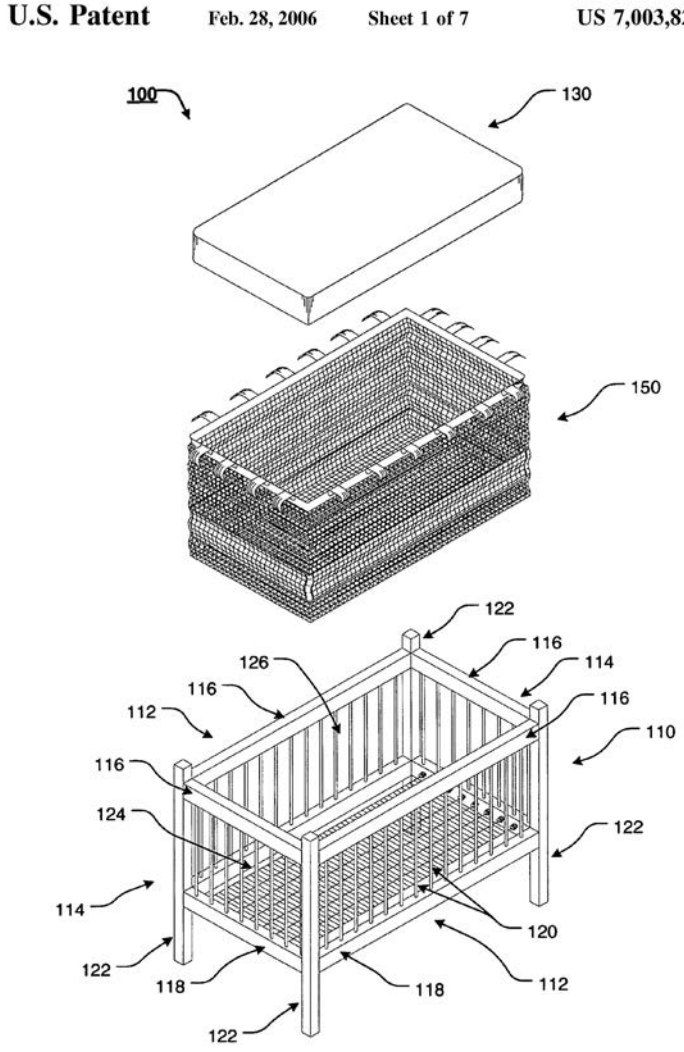

Figure 3. Patent Drawing

analyzing their idea in the eyes of the consumer. Have students start by looking at product advertisements and see if they notice that many start by highlighting a problem or a shortcoming of an existing product.

CONCLUSION

Technology and engineering educators have used the engineering design process for years to help students solve problems and develop critical thinking skills. The engineering design process, however, should not be an end unto itself. Understanding the patent process strengthens interdisciplinary connections and technological literacy. *Standards for Technological Literacy: Content for the Study of Technology/STL* (ITEA/ITEEA, 2000/2002/2007) addresses engineering design and intellectual property in multiple standards because they are a cornerstone of technology and engineering education. We are the discipline that provides the necessary depth of these topics for a technologically literate citizenry.

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