Section 1. Patents

1 Overview of Patents

This section provides a high level description of various topics related to patents. This information is broad and so greater detail is included in subsequent sections. Since patents are an extremely complex subject, the description below focuses on the most important concepts and generalities that would be of interest to non-lawyers; it does not go into the great many exceptions and niche concepts that one would find in materials targeted to lawyers. To give greater clarity and simplicity, this document is deliberately incomplete in many ways, but these deficiencies should not at all matter to the technologists, business executives, or entrepreneurs who wants to understand patents and use patents in their work.

Although the focus is on the US patent system, most of this material applies to the patent systems of many other major jurisdictions in the world.

1.1 The term "patent"

The word "patent" can refer to two similar but different concepts. You should be aware of the distinction to avoid confusion.

The first meaning of "patent" is a document that is published by a patent office (such as the U.S. Patent & Trademark Office or the European Patent Office) and that describes a particular invention by a particular inventor or team of inventors. For this sense of the word "patent", one might say something like "I read Jay Whitacre's patent for solid-state Lithium ion batteries".

The second meaning of "patent" is the set of legal rights that a particular inventor or team of inventors receives for their invention. For this sense of the word "patent", one might say something like "Jay Whitacre has a patent on his Lithium ion battery technology." Similarly, the word "patent" can be used as a verb to refer to the act of acquiring these legal rights. For example, one might say "Jay Whitacre patented his Lithium ion battery technology."

1.2 Policy reason for patents

In summary, a government creates a patent system in an attempt to overcome an economic problem: the externalities of inventing activities. This explanation involves several concepts that must be discussed to understand the details of the policy problem and the intended solution.

An externality is a concept in economics. An externality is a cost or benefit that a transaction imposes on people other than the parties to the transaction. The classic example of an externality is pollution. The costs of pollution are imposed on people (e.g., residents near a factory that pollutes) who did not choose to interact with the pollutor, and so did not agree to receive the burden of the pollution. This is a negative externality since there are negative consequences imposed on these people who are not parties to the transaction between the factory and its customers.

An externality can be positive instead of negative. For example, if several stores on a street hire security guards at night to patrol the area outside the stores, this will tend to discourage crime in
that area. This lower crime provides a benefit to neighboring stores even if they did not pay for any security. These neighboring stores are not part of the transaction between the stores and the security guards (for example, they do not pay for increased security), but these neighboring stores nevertheless receive a benefit from the transaction.

Inventing new technology often creates positive externalities. These positive externalities from inventing activity arise due to several reasons, two of which are easiest to describe. The first reason is that developing new technology can be very costly, but understanding and copying that same technology can be relatively inexpensive. For example, new pharmaceutical compound can easily cost hundreds of millions of dollars in research and development. Yet once the compound has been created, others can understand it and duplicate it without having to invest in the same amount of research and development.

The second reason is that technological information, such as the design of the new technology, can be easily shared. In fact, it can be very difficult for the creator of a new technology to both sell the technology to others and also prevent others from learning its details. For example, once a pharmaceutical company sells a new drug, the company is essentially releasing the details of how to copy the drug to buyers as well as to others who are not buyers.

In theory, a way to overcome these problems would be to have all buyers of new technology agree to not duplicate the technology and agree to not tell others how the technology works. For example, a pharmaceutical company could require all buyers of a new drug to (1) never duplicate the drug, (2) never tell anyone else how the drug is made, and (3) never give the drug to anyone who might try to duplicate the drug. Unfortunately, this would be virtually impossible to enforce on a large scale. Imagine that you were a pharmaceutical company executive with a new drug that is expected to generate billions in profits in the coming decades, provided your competitors do not copy it and offer the same drug to customers. Now imagine that you tried to enforce this agreement described above. It is likely that a customer would break their promise and instead leaked that extremely valuable information to a competitor. Once this information is leaked it cannot be taken back.

Using terminology from microeconomics, this problem occurs because the valuable information on a new invention is both non-rival and non-excludable. Non-rival means that one person can use the information even while another person uses the information – information is easily copied to another without depriving the inventor of the information. Non-excludable means the owner of the information cannot effectively prevent people who have not paid for the information from using it. For example, if someone publishes details of an invention on the Internet, people who have not paid for the information can still read it. In contrast, tangible goods are typically excludable because they can be used by only one person at a time. For example, the owner of a bicycle can sell the bicycle to one person who pays for it, and there is no concern that others will use it without paying.

A patent system is intended to overcome these problems. Specifically, a patent gives its owner the right to exclude everyone from making, using, or selling the patented invention unless the patent owner gives permission to do so. Anyone who tries to make, use, or sell the patented invention without the permission of the patent owner can be sued, forced to stop, and compelled to pay money to the patent owner for past uses of the invention.

This means that the patent system is a way to transform technical information on how to make and use a new invention into a marketable asset that can be sold to others for its full value. Although the technical information about the new invention can be used by several people
simultaneously (e.g., to make copies of the new invention and sell the invention to customers),
the patent owner can charge for all these uses. A patent thereby stops the positive externality, and
removes a disincentive from creating new inventions.

1.3 Types of inventions that can be patented

There are two broad categories of inventions that can be patented:
- products (e.g., a tangible product, a component of a product)
- methods (i.e., a process, an algorithm, a recipe, any series of steps)

Almost anything tangible is a 'product'. Examples of products include
- a machine (e.g., a jet, a calculator, a guitar)
- a component of a machine (e.g., a microprocessor, a jet engine)
- a computer programmed with particular software (a web server, an XBox, an iPhone
  running a particular app)
- other tangible products (e.g., a cup, a fence, a doorstop)
- a chemical compound (e.g., hydrogen peroxide)

Anything which is a series of steps to perform is a 'method'. Examples of methods include
- the set of steps performed in synthesizing a particular chemical compound
- the set of steps performed in manufacturing a particular semiconductor device
- a software algorithm for translating speech to text
- a recipe for making minestrone soup

This does not mean that an invention is patentable merely because it is either a product or a
method. An invention must satisfy additional requirements in order to be patentable. Being either
a product or a method can be viewed as just one requirement for patentability of an invention.

1.4 Uses of Patents

A U.S. patent gives its owner the right to exclude any other entity (e.g., a company, a person)
from producing or using the patented invention anywhere in the U.S. anytime during the life of
the patent. More specifically, a patent is a legal instrument that gives the patent owner the right\(^1\)
to exclude others from:
- selling the patented invention
- offering to sell the patented invention, even if it is merely advertised but not actually sold
- using the patented invention
- making the patented invention
- importing the patented invention into the U.S.

There is a fairly counter-intuitive concept that deserves to be mentioned briefly at this point. A

\(^1\) Like most legal rights in most countries, enforcing the right typically involves a request to the other party (e.g.,
to refrain from selling the patented invention). If the request is unsuccessful, the patent owner can commence
litigation to have a court enforce the right.
patent gives its owner the right to exclude others, but it does not give the patent owner the right to make (or use, sell, etc.) the patented invention. For example, although Anne owns a patent for a new 3D printer, it is possible that she may nevertheless not have the right to make that 3D printer. One reason for this restriction might be that another person has a patent on a necessary component of Anne's 3D printer. This patent can be used to exclude Anne from making her 3D printer (or anything else that uses the component).

The fact that a patent does not give the inventor the right to make her invention can create some interesting difficulties, and leads to certain types of activities by patent owners. We will discuss this situation in greater detail in a later section.

1.5 The Basic Process for Obtaining a Patent

Below is an overview of the process one must go through to acquire patent rights. The process is much more complicated and the details will be explored in a later section.

1) The inventor creates a new invention
2) The inventor applies for a patent by filing, with the patent office, a patent application which describes the invention in detail
3) The patent office checks whether the invention meets all requirements for patentability
4) The patent office either rejects the patent application or grants a patent to the inventor
5) If the patent application is rejected, the inventor can try again by appealing

In the U.S., it typically takes several years after the application is filed for the patent office to evaluate the application and render a decision on whether the patent will be granted. If the patent office rejects the patent application several levels of appeal are available, so it is possible that after an initial rejection a patent is eventually granted.

The U.S. patent office may, and often does, inadvertently grant a patent for an invention that does not satisfy all patentability requirements. Such a patent can be subsequently revoked by the patent office or by a court.

The typical lifetime of a U.S. patent is usually about 17 years. The lifetime of a patent starts the day the patent office grants the patent. This lifetime is the period during which the patent owner can exclude others from making, using or selling the patented invention.

1.6 Monetization of Patents

In general, a patent owner can monetize (make money from) a patent in three ways:
1. Sell the patent to another entity² such as a person or a company
2. License the patent to one or more entities
3. Prevent other entities from using (or making, selling, etc.) the patented invention

Patent rights (i.e. #3 above: the right to exclude others from making, using, etc.) are available only during the life of the patent, which starts on the day the patent is granted by the patent

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² Actually, a patent is like many other assets in that two or more entities can be joint owners of a single patent, so a patent can be sold to more than one entity. However, this can be disadvantageous for a number of reasons and so it is uncommon.
office. The patent owner cannot prevent others from duplicating the invention until the day the patent is granted.

However, the patent owner can sell or license a patent application (#1 and #2 above) after or before the patent office has granted it – i.e. the patent application has been filed but not yet granted. It may seem odd that a patent could be sold even though a patent has not yet been granted, and in fact might never be granted. It may be helpful to think that the purchaser in this situation is paying for the possibility that a patent will be granted. This looks very much like a financial option, such as stock option, which has value though the desired event (e.g., the stock becoming valuable) might never occur.

Usually, the value of a mere patent application that has not been granted as a patent is substantially lower than the value of the corresponding patent when it is granted. For example, before the patent is granted it is sold for $10,000, but immediately after it is granted it can be sold for $100,000. This discounted value reflects various uncertainties and risks, such as the risk that the patent will not be granted at all, will not be granted in a timely manner, or will be granted but will not cover the desired aspects of the invention (see "Scope of a Patent").

Each of the three ways to monetize a patent are briefly described below.

1. **Sell the patent**
   A sale is most typically a single, simple transaction. The buyer pays a price and receives the patent from the owner. As in sales of other assets, the buyer acquires everything the seller had (all patent rights previously held by the original patent owner). The original owner is left with no rights. Because of this straightforward acquisition of all patent rights, an entity that is interested in a patent might consider a purchase of the patent to be more desirable than, e.g., licensing the patent.

2. **License the patent**
   A license is a contract in which one or more other entities pay the patent owner so they have permission to make, use, etc. the patented invention. The recipient of this permission is called a "licensee", and the patent owner who grants the permission is the "licensor".

   The license may include various types of restrictions. For example, the license may only be in effect for a limited time (e.g., the licensee can sell the invention for only three years), or may be in effect in a particular geographic area (e.g., the licensee can sell the invention only in New York and California).

   The license may include conditions. For example, the licensee may be required to sell at least one million units by January 1, 2020 in order for the license to be renewed for another three years, otherwise the license expires on that date.

   In general a license can include any restrictions and conditions that a licensor and licensee agree to. This allows the design of complex licenses that carry out a variety of sophisticated business goals.

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3 Since the patent owner has the right to exclude anyone else from making (and using, etc.) the patented invention, technically what the licensee receives is a promise that the patent owner will not enforce that right to exclude against the licensee.
3. Prevent others from using (or making, selling, etc.) the invention

The patent can be used to exclude others from making, using or selling the patented invention. This is true even if the other party who is excluded did not copy the invention from the patent owner, but instead independently developed the invention.

The right to prevent others from making, using or selling the patented invention is often exercised in order to make the patent owner the sole seller of the invention. It may also be exercised as a first step in forcing the other party to license the patent. This latter situation can occur when the other party has been selling the patented invention but refuses to pay the patent owner for a license or refuses to pay the amount the patent owner wants for the license.

It may not be obvious that there are potential drawbacks to being the sole source of the patented invention. This can be very desirable for the patent owner in some situations but terrible and unprofitable in others. For example, operating as the sole source may be difficult or inefficient in light of the existing industry structure for making and using the invention. The patent owner may not be the most efficient manufacturer of the invention, or may not have established relationships with the most efficient distributors of the invention. The patent owner might be in an entirely different line of business and have no desire to expand into the field that the patented invention represents.

In such circumstances, the patent owner may not be able to make the highest quality product that otherwise could be made, or may not be able to deliver the invention to the most customers at the lowest cost. If so, a license to the entities in the industry who have superior skills can be both more profitable for the patent owner and more beneficial to consumers. This would also be the situation with the highest net social benefit in general, since the most capable entities are producing the invention presumably at the lowest cost of production.

1.7 Two requirements for patentability

There are many requirements that must be satisfied in order to be granted a patent. Some are substantive requirements that the invention itself must satisfy, while others are procedural requirements that specify exactly how the inventor must apply for a patent.

The manager, technologist, or entrepreneur will most often deal with issues relating to two very common and important requirements:

- the invention must be "absolutely new"
- the invention must "work"

For clarity and pedagogical purposes, in this section we will use different terminology than the terminology used in the patent laws and patent office regulations. For now you should recognize that the terms "absolutely new" and "work" are not common, though they should be much easier to remember and understand. After you have formed a solid understanding of the requirements for patentability in this simpler terminology, we will eventually introduce the actual terminology so that you can converse fluently with patent professionals.

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4 One fairly straightforward requirement is that the person seeking the patent actually invented the invention. You cannot patent an invention that you copied from someone else.
1. **Requirement: The invention must be absolutely new**

   In summary, an invention is “absolutely new” if:
   - the invention did not previously exist, and
   - nothing “too similar” to the invention previously existed

   Both requirements essentially compare the invention under consideration with all previous inventions that were created earlier. To satisfy the first requirement, the invention under consideration must be "different" in any way from previous inventions. To satisfy the second requirement, the invention must be "different enough" from previous inventions. The first requirement is clearer because any differences whatsoever are sufficient. The second requirement unfortunately involves an amount of subjectivity and ambiguity, so it is not always clear whether an invention satisfies the second requirement.

   An invention under consideration is not absolutely new if, before the inventor files the patent application, the same (or a somewhat similar) invention has ever been implemented, made, sold, written about, or even merely discussed.

   It is possible that the invention under consideration is similar to, but not identical to, something that has already been made, written about, etc. If the previous invention is “similar enough”, then that renders the current invention unpatentable.

   It can be difficult to determine whether a previous invention is “similar enough” to the invention under consideration. The general test is somewhat imprecise: the person having ordinary skill in the field would not consider the invention under consideration to be “obvious” in light of the previous invention. One blunt way to determine whether a previous invention is “similar enough” to the current invention is to ask whether the invention under consideration adds value compared to the previous invention. If the differences of the invention under consideration add some value, then the current invention might be considered different enough, and therefore would be "absolutely new". The more value that the invention under consideration has compared to a previous, similar invention, the more likely it is that the invention under consideration is “absolutely new”. Although this test is not guaranteed to provide the correct answer, it is simple and often helpful. It is also helpful to examine the value added by an invention simply because that can indicate the business strategy involved in profiting form the invention.

   To assess the likelihood that the current invention adds enough value to be “absolutely new”, compare two hypothetical sales: a sale of the invention under consideration and a sale of the closest substitute to the invention under consideration. Estimate the *additional* profit from the invention under consideration to determine whether it would generate much more profit than the substitute. For example, if the profit from selling the substitute product would be $p_1$, and the profit from selling the current invention would be $p_2$, then the additional profit (added value) of the current invention is the difference in the two profits, the quantity $p_2 - p_1$.

2. **Requirement: The invention must work**

   For an invention to be patentable, the patent owner must describe (in the patent application filed with the patent office) either exactly how to build the invention or how to have it built (through sufficiently detailed instructions that would allow one or more people with the required expertise to build it).

   Whether an invention works can be viewed as a spectrum. At one end of this spectrum is an
invention that cannot possibly be described sufficiently because nobody knows exactly how to build it. For example, an invention that is beyond the current technological capabilities of humankind cannot be built, so certainly nobody can describe how to build it. Therefore any description of this invention cannot “work”, so the invention is not patentable.

At the other end of the spectrum is an invention so simple that the inventor could describe enough details to allow almost anyone with no special knowledge whatsoever to build the invention. For example, a wedge-shaped doorstop made from clay might be so simple that anyone would easily understand exactly how to make it from the description.

Most inventions lie somewhere between these two extremes. The vast majority of inventions that can be made require some specialized knowledge that many people possess. This specialized knowledge might be necessary only to create a small portion of the invention, or might be necessary for creating all aspects of the invention. An invention might require knowledge of things such as how to build:

- an interactive web page
- a spreadsheet program that calculates some mathematical formula
- a digital camera
- a car engine
- a multi-core microprocessor

Although you might not know how to build any of these five types of technology, you nevertheless know that this level of knowledge is certainly possessed by many, many people. You know this because you know that each of the above is something that is currently made by several companies. Even if you do not understand any of the details of these five types of technology, you certainly recognize that the people that can make them are in various technological fields, and some of these people have the "typical" or "average" level of skill in their field.

If we assume the average person in the relevant technical field could build each of these five types of technology, then a patent application that needed to describe them would not need to describe the details of how to build these five types of technology. A simple naming of the item in the patent application would be sufficient. The patent application might even describe the five types of technology in more detail by referencing a journal article or an earlier patent that contained an appropriate description.

This means an inventor can sufficiently describe, and be granted a patent for, an invention which that inventor could not build without significant assistance from others. This is in fact how many product developers operate: they describe a product to different people who have expertise in different areas, and these people cooperate to build the product, even if no single person possesses the knowledge to build the product alone.

To determine whether an invention requires knowledge that is commonly possessed, it helps to identify what kind of person or company would be able to build it. For example, you can reasonably conclude that the company Intel, as well as many other companies, can manufacture different types of microprocessors because they currently do so. Therefore, in a patent application for an invention that requires this type of microprocessor, you could simply include a reference to that microprocessor, rather than describe in detail how to manufacture it.
1.8 Scope of Patent

An important but subtle point worth mentioning briefly at this point is that a patented invention is almost always defined as a set of features. The more features there are in this definition of what the invention is, the narrower (i.e. more specific) the patented invention is. If there are few features then in general the invention is broad.

For example, a very broad pencil invention is one which includes the following three features:
- a wooden pencil, cylindrical in shape, between 2 and 4 inches long

A similar but narrower pencil invention is one which includes the following six features, three of which are the same as in the previous example:
- a wooden pencil
- the pencil is cylindrical in shape
- the pencil is between 2 and 4 inches long
- the pencil is colored with light yellow paint
- the pencil has a pink vinyl eraser
- the eraser is attached to the end of the pencil with glue

This second example has all three features that the first example has, plus three more features. This makes the second example narrower than the first example. Another way of saying this is: anything that has all the features of the second example must also have all the features of the first example. However, some things that are instances of the first example are not instances of the second example, such as a pencil that is colored with red paint instead of light yellow.

The broader a patented invention is, the more valuable it is. This is because the broader the patented invention is, the wider the set of products the patent covers. A wider set of covered products means the patent can be licensed to more entities and / or the patent owner can charge for more products sold.

However, the broader an invention is, the less likely it is patentable. This is because the broader it is, the more likely that it is similar to some previous invention, which means the invention fails to be “absolutely new”. For example, it is necessarily easier to find instances of previous (earlier-created) inventions with three features than to find instances of previous inventions with those three features plus three additional features.