PATENT CLAIM LANGUAGE GAMES:
WHY INTERACTION WITH OTHERS AND WITH THE
EXTERNAL WORLD IS INTEGRAL TO INVENTIONS

by

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A thesis submitted in conformity with the requirements for the degree of LL.M.
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PATENT CLAIM LANGUAGE GAMES: WHY INTERACTION WITH OTHERS AND WITH THE EXTERNAL WORLD IS INTEGRAL TO INVENTIONS.” A thesis prepared by Ian C. McMillan for the requirements of an LL.M. degree, Faculty of Law, University of Toronto, September 2001.

ABSTRACT

This thesis draws on literature in the philosophy of language and science and considers several United States Supreme Court cases to examine how claims are construed to protect inventions.

The thesis describes philosophical arguments why knowing the meaning of words requires interaction with others and with the external world. These arguments are applied to patent claims to argue that construing the words of patent claims will require interaction with others having relevant skill and with the external world. A parallel argument is made that the determining variants of an invention will also involve interaction with others having relevant skill and with the external world. Seemingly inconsistent rules of claim construction, such as the doctrine of equivalents, are reconciled with the requirement that inventions be defined by the claims once an externalist view of language and the invention is adopted.
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CHAPTER ONE: INTRODUCTION

A patent has two main roles. One role is to describe an invention so that anyone having the relevant skills can practise the invention. As a result of issued patents describing inventions being publicly available throughout the world, information about a host of different technologies is widely disseminated. The second role of a patent is to provide the owner of the patent with the right to stop others from making, using or selling the invention during the life of the patent. To determine the extent of this right, the patent must define the scope of the right to exclude others, and must clearly distinguish the claimed subject matter from that which is not claimed. This second role of a patent is performed by the claims, which define variants of inventions.

The patent system cannot perform its role of publishing inventions unless inventors file patent applications. An inventor will not file a patent application unless the right to stop others from making, using or selling the invention during the life of the patent extends to all variants of the invention of which competitors are likely to think. If there is any route around the protection afforded by the patent of which competitors would readily think, then the patent is valueless regardless of how many variants of the invention it does cover. How a patent provides the right to exclude others from using an invention depends on how the claims of the patent are written, construed and enforced. Thus, how claims are written, construed and enforced is critical to patent law.

This thesis has a couple of aims. Its starting point is the observation that claims play a critical role in patent law, and that any effort to understand patent law should include an effort to understand the role that claims play. Understanding the role that claims play entails understanding how the words of the claims are used to refer to variants of the invention, and understanding how variants of the invention are apparent to the inventor and to others. In seeking to understand how we are able to use language, including the specialized vocabularies and nomenclatures of science, philosophers of language and science have challenged a mentalist view in which it is the private contents of one’s mind that enables one to use language. The first aim of the thesis is to show that the examples and arguments provided by this philosophical challenge can be applied to illuminate the role that the language of the claims plays in the field of the invention.
According to a mentalist view of science and language, things in the external world can be analyzed and broken down into fundamental elements. These fundamental elements can then be named using the individual words of our language. When the words are spoken or read, the meanings of these words are grasped. The meanings of these words are the thoughts corresponding to the fundamental elements named by the words. These thoughts also correspond to everything that is like the fundamental elements in relevant ways. By naming the fundamental elements of reality, our language and thought provide a correlate picture of the world. This correlate picture of the world can be obtained merely by grasping the meanings of words. No interaction with others or the external world is required to grasp the meanings of these words. As language expresses a correlate picture of the world, fundamental truths about the world can be investigated merely by investigating the nature of our language.

Viewed from a mentalist standpoint, the role that claims play in patent law seems clear. Like other things, inventions can be broken down into fundamental elements. Patent claims can then be written using the words that name the fundamental elements of the invention. When the claims are read, the meanings of the words naming the fundamental elements of the invention are grasped. The meanings of these words are the thoughts corresponding to the fundamental elements named by the words. These thoughts also correspond to everything that is like the fundamental elements of the invention in relevant ways. Thus, the claims provide a correlate picture of the invention, such that the invention can be understood and distinguished from what is not the invention simply by reading the claims and grasping the meanings of the words of the claims. In fact, the claims provide a correlate picture of the invention such that the nature of the invention can be investigated merely by investigating the meanings of the words of the claims and without interacting with any actual variants of the invention.

Even a brief look at the patent infringement case law reveals the difficulty inherent in writing patent claims that always yield the desired result – that always distinguish the invention from what is not the invention.¹ This difficulty is made more apparent by the fact that it is acceptable to design around the claims. By applying what is variously called a literal reading, plain meaning or strict construction of the claims, judges have

¹ See, for example, Hitchman and MacOdrum, "Don't Fence me in: Infringement in Substance in Patent Infringement Actions" (1991) 7 C.I.P.R. 167.
often construed claims in a manner that is consistent with a mentalist view of language and technology. That is, the judges have often construed claims without considering the actual operation of variants of the invention. However, judges have also departed from this view "to temper unsparing logic and prevent an infringer from stealing the benefit of an invention...". In these departures from the mentalist view, judges have considered actual variants of the invention and whether the alleged infringement is the same as these actual variants in relevant ways. By departing from the mentalist view, judges have implicitly registered their dissatisfaction with it, and through precedents have provided rules that are inconsistent with it. However, without another view of language and technology, these rules seem incoherent as they permit seemingly arbitrary departures from a mentalist view of language.

In fact, alternatives to the mentalist view of language do exist. Philosophers of language have repeatedly challenged mentalist views of language and have offered alternative views. In this thesis, I will rely on perspectives provided by Ludwig Wittgenstein, Hilary Putnam and Thomas Kuhn. In the *Philosophical Investigations* Wittgenstein brings problems with the mentalist view to our attention by describing instances of language use that do not seem to conform with the mentalist view. Instead, these examples of language use show how language is part of interaction with others and with the world. Wittgenstein uses the term "language games" to refer to these instances and to emphasize that speaking a language is part of an activity or a form of life. Language depends on agreement in judgment among human beings, which we can observe. Nothing is gained by then inventing something mental or spiritual called meaning, which purportedly explains or grounds this agreement. To Wittgenstein, it is a mistake to attempt to explain the agreement in judgment that we observe in the use of language. All explanation must inevitably come to an end somewhere, as explanation involves words and we must ultimately move from words to the external world. As all explanation must end somewhere, we should end it before we invent the need for some correlate picture of reality that explains our use of words.

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In *The Structure of Scientific Revolutions*, Thomas Kuhn uses examples drawn from the history of science to argue that scientific disciplines are not constituted by laws of nature, but rather by paradigms of which laws of nature are only a part. Through long and intensive training, these paradigms are instilled into scientists and help to determine the forms of life in which the scientists participate. The fact that scientists share these paradigms leads them to agree in their judgments about the external world, thereby allowing the development of words or symbols to express this agreement. However, these words or symbols do not designate concepts that mirror fundamental realities, but are only expressive of agreement within a particular form of life shaped by particular paradigms.

Hilary Putnam's approach is very different from that of Wittgenstein and Kuhn. Instead of shifting attention to actual language use and showing how this language use is inconsistent with or at least not illuminated by a mentalist view of language, Putnam uses a thought experiment to carefully investigate a mentalist view of language and to show that this view of language is ultimately incoherent. Despite these differences in approach, Putnam, like Wittgenstein and Kuhn, argues that knowing the meaning of words requires interaction with others and with the external world. I will use the term "externalist" to refer to this common thread in Wittgenstein and Putnam's writings. The second aim of this thesis is to show that an externalist reading of claims is required to adequately protect inventions.

An understanding of the role that patent claims play is critical to this thesis. Accordingly, I begin by describing how claims are initially drafted, refined through the patent application process, and ultimately enforced or invalidated in an action for infringement. I will also describe the typical response by a defendant alleged to have infringed the patent, which might include counterclaiming that the claims are invalid and attempting to design around the claims. These descriptions are combined in an account of interaction between two inventors, Fred and Betty, and the way in which they use language within the context of the patent system to interact with each other and the natural world.

Many of Wittgenstein's observations seem to be generally applicable to patent claims. After Fred and Betty's patent claims are described, some of Wittgenstein's observations

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*Kuhn, Thomas S., 3rd edition, (The University of Chicago Press, 1996)*
are applied to these claims to show that the language of patent claims does not take its entire use from some picture of the invention residing in the inventor's mind, and that the full range of application of the words of a claim cannot be grasped simply by reading the claim. Instead, the words of a claim provide ways of interacting with others and the world to identify variants of an invention.

Claims must also be construed in a way that encourages inventors to file patent applications instead of trying to keep their inventions secret. However, the protection provided must not be so broad as to unnecessarily impede competition. Similar to words, inventions are also not determined solely by what is in the inventor's mind. Often the inventor will have to interact with others and with the external world to determine ways of implementing the invention. Thus, an externalist reading of claims is required to adequately protect inventions.

The bulk of the thesis describes cases decided by the United States Supreme Court. The facts of many of these cases make it clear that if patents are to fulfill the objective of rewarding inventors and encouraging the progress of the useful arts and sciences, then inventions must be thought of in an externalist way. While it is not always easy to discern the view of language that a court relies upon in deciding whether patent claims are valid or infringed, it is sometimes possible. While some of the decisions of the United States Supreme Court reflect a mentalist view of language and inventions, others seem to explicitly recognize that such a view is inconsistent with the objectives of patent law.
CHAPTER TWO: THE ROLE OF PATENT CLAIMS

An inventor of a new, useful and unobvious machine, process composition of matter or product may apply for a patent. The application must include claims that define the invention and a description of the invention that is sufficiently detailed to permit a skilled worker to practise the invention once the patent expires. On issuance of the patent, the patent owner is granted a right to exclude others from making, using or selling the invention for a pre-defined term – in the case of Canada, as with most countries, the patent will expire 20 years after the application was filed. The subject matter of the right to exclude others must be defined in distinct and explicit terms.

In Mineral Separation v. Noranda, President Thorson formulated a general statement of what it means for a claim to define an invention in distinct and explicit terms:

"By his claims, the inventor puts fences around the fields of his monopoly and warns the public about trespassing on his property. His fences must be clearly placed in order to give the necessary warning and he must not fence in any property that is not his own. The terms of a claim must be free from avoidable ambiguity or obscurity and must not be flexible; they must be clear and precise so that the public will know not only where it must not trespass, but also where it may safely go."

The first step in defining the right to exclude others in distinct and explicit terms in the claims is to analyze the invention – to break it down into the elements that will be used to define the invention. Both the invention, and the previously known technology in the field of the invention (the prior art) must be thoroughly understood as the elements are chosen to distinguish the invention from the prior art. A first claim is then drafted to include these elements.

Once the first claim has been drafted, it should be tested against the patentability requirements of novelty, utility and unobviousness. For a claim to meet the utility

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5 Patent Act, R.S.C. 1985, c. P-4, sections 2, 28.2(1) and 28.3.
6 Ibid, section 27(3).
7 Ibid, at section 44. This provision applies to patents maturing from applications filed after 1 October 1989. In the case of applications filed before this date, former section 45 stipulated a term of seventeen years from the date of grant. However, this provision has been successfully challenged by the United States before the World Trade Organization, which ruled on 18 September 2000, that this provision was inconsistent with TRIPS. Bill S-17, declared in force on 12 July 2001, extends the term of these patents to a minimum of 20 years from the application date, or 17 years from grant date, whichever is longer.
8 Ibid, section 27(4).
requirements, the claim must define operable subject matter – all of the embodiments of
the invention covered by the claim must work. If all of the elements recited by the claim
cannot be assembled into an operable embodiment without adding additional elements
not recited by the claim, then the claim is not allowable as drafted and these additional
elements must also be recited by the claim in order to limit the scope of the claim to
operable subject matter.

Once the claim appears to define operable subject matter, it should be read against the
prior art. To read a claim against the prior art is to go through the claim, element-by-
element, to determine if each element is found in the prior art. If all of the elements, and
their relationship as defined by the claim, are found in any single item of prior art –
whether an actual working device or a publication disclosing such a device – then the
claim is anticipated (lacks novelty). Generally, "that which infringes if later, anticipates if
earlier." Accordingly, a common body of case law is used to both determine if a claim
is valid and to determine if a claim is infringed, and this body of case law should also
guide the patent agent in "reading" the claim against the prior art. Provided the invention
and the available prior art were understood, the claim should refer to at least one
element that is not found in any single item of prior art. However, some of the prior art
may have been misunderstood, or new prior art may have been found, or the elements
may have been worded too broadly so that they read on the prior art. Reading the claim
against the available prior art, and rereading the claims as new prior art is found, checks
for these errors.

Even if all of the elements and their relationship as defined by the claim are not found in
any single item of prior art, they may be found in the teachings of some collection of prior
art items. Alternatively, it may be arguable that an element that is not found in any of the
prior art would nonetheless have been obvious to one having relevant skill. For
example, consider an allegedly inventive alloy that is claimed in a patent. All of the
elements in the claim are found in a prior alloy except that the allegedly inventive alloy
includes titanium as a hardening agent while the prior alloy includes boron. While it may
not have been clear to a layperson or a judge that titanium could be substituted for boron
this would have been apparent to a metallurgist as both boron and titanium are

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10 Supra, note 5 at section 2.
commonly used as hardening agents. As the claim is read from the perspective of one skilled in the art, it would be invalid for obviousness. Thus, a claim may meet the requirements of utility and novelty, but still be invalid for obviousness. Accordingly, the elements of the claims must provide the basis for an argument that any device containing these elements offers advantages over the prior art, and that this would not have been obvious to one having skill in the field of the invention.

Generally, in drafting the claims and thereby defining the right to exclude others to be provided by a patent, the claim writer is faced with a dilemma. If the claims are too broad, then they will read on the prior art, or inoperable subject matter, or on more than was described, and will be invalid. Alternatively, if the claims are too narrow, then it may be possible to practise the invention without infringing the claims thereby permitting others to avoid the patent. It is impossible to ascertain where the exact boundary between the invention and the prior art lies.

To resolve this dilemma, a number of claims of varying breadth are typically included in a patent. Each claim is often thought of as defining a boundary surrounding the territory in which a right to exclude others is claimed. Once a patent issues, the claims will be presumed to be valid, and the owner of the patent will have the right to keep others outside the territory surrounded by the boundaries defined by the claims, as well as the right to sue others for patent infringement in the event that they step inside these boundaries.

The broadest claims within a patent define the boundaries that surround the most territory. As the broadest claims cover the most territory, they are also the most valuable, provided they are valid. A claim is invalid if it covers that which was already known or obvious, inoperable subject matter, or more than is disclosed in the patent. The broadest claims are more likely to be found invalid in this way because they cover the most territory, and are therefore more likely to cover forbidden territory. When a claim is considered by a court in litigation, the claim stands or falls as a whole. If the territory covered by the claim includes any territory that was previously known and is therefore properly part of the public domain, then the claim as a whole is invalid,
notwithstanding the fact that much of the territory covered by the claim was not previously known.\textsuperscript{12}

In order to guard against the possibility that the broadest claims will be found to be invalid, patent agents draft a series of claims of varying breadth. Each claim represents boundaries on which the patent owner can rely even if the broader claims are found to be invalid. The following example traces the life of a family of claims from their initial creation, through the patent application process and ultimately through an enforcement proceeding.

\section*{2.1: The life cycle of a claim}

Consider a historical period just after the wheel has been invented.\textsuperscript{13} While the wheel has greatly facilitated transportation, there have been problems in its implementation. The fact that wheels are round means that the portion of the wheel that is against the ground at any time is likely to slip, greatly reducing efficiency and in some cases rendering the wheel useless. Fred, a stone age inventor, has devised a solution to this problem. He has found that covering the circumferential surface with tree bark reduces slippage. This innovation reduces the efficiency of the wheel somewhat by varying its radius of curvature, but Fred thinks that this loss of efficiency will be more than offset by the reduction in slippage.

In this case, Fred takes the prior art to be a smooth stone wheel. The point of invention seems to him to be the roughened surface of this smooth stone wheel. However, he is not aware of anyone else who has shown how wheel slippage can be reduced by adding anything that reduces wheel slippage to the circumferential surface of the wheel. Accordingly, he decides to draft a broad claim that does not refer to the roughness of the circumferential surface, but instead refers to anything that is applied to the circumferential surface of the wheel to reduce slippage. When any one of a variety of obvious devices can be used to achieve a certain function, a generic element can be

\textsuperscript{12} In many jurisdictions, it is possible to seek re-issuance or re-examination of the patent after grant provided certain conditions are met. See, for example, the \textit{Canadian Patent Act, supra} note 5 at sections 47 and 48.1.

\textsuperscript{13} Since writing my thesis, I have been advised of another description of claim drafting that traces the development of tires for wheels. This description is found in Ross, J., \textit{Beyond a Better Mousetrap: An Introduction to Patents} as included in volume 1 of the course materials prepared by Norman Siebrasse for the 1997 Intellectual Property Course at the Faculty of Law, University of Toronto.
expressed by specifying the function and then adding “means”. Accordingly, anything that reduces slippage can be designated using "slippage reduction means".

Fred files a patent application including the following claims:

1. A wheel for reducing slippage, the wheel comprising a circumferential surface; and slippage reduction means applied to the circumferential surface.

2. The wheel as defined in claim 1 wherein the slippage reduction means comprises a roughened surface overlying the circumferential surface.

3. The wheel as defined in claim 2 wherein the roughened surface comprises tree bark.

4. The wheel as defined in claim 3 wherein the tree bark is glued to the wheel.

5. The wheel as defined in claim 3 wherein the tree bark is tied to the wheel.

In the claims, Fred has broken down the invention down into elements. He has identified the inventive element as something that is applied to the circumferential surface of the wheel to reduce slippage. This inventive element is most broadly characterized using the term "slippage reduction means". The only other element recited is the circumferential surface of the wheel. This element must be recited in order to define the interaction of the slippage reduction means with the rest of the wheel. In addition to reciting the elements of the invention, claims must also recite the interaction of these elements. In narrower claims 2 and 3, the inventive element is described with greater specificity to confine the scope of the right to exclude others. In still narrower claims 4 and 5, the interaction of the inventive elements with the circumferential surface of the wheel is defined in more detail.

During prosecution of Fred’s patent application in the Patent Office, the Examiner searches for relevant prior art and finds that both claims 1 and 2 read on previously
known subject matter. Specifically, both of these claims read on early wheels that had unfinished, and consequently rough, circumferential surfaces. Claims 1 and 2 are accordingly rejected. However, the Examiner does not find any prior art showing a wheel having tree bark applied to its circumferential surface. Accordingly, claim 3 is valid and a patent issues containing former claims 3 to 5, renumbered as claims 1 to 3 of the issued patent. Former claim 3 will also be rewritten as claim 1 to include the base limitations of cancelled claims 1 and 2 from which it formerly depended. Thus, claims 1 to 3 of the issued patent read as follows:

1. A wheel for reducing slippage, the wheel comprising
   a circumferential surface;
   rough-surfaced tree bark applied to the circumferential surface.

2. The wheel as defined in claim 1 wherein the tree bark is glued to the circumferential surface.

3. The wheel as defined in claim 1 wherein the tree bark is tied to the circumferential surface.

A patent is infringed if any of its claims are infringed. A claim is infringed if all of the elements it recites are found in the alleged infringement - the elements are individually necessary and collectively sufficient conditions for infringement. Any wheel that is covered by rough-surfaced tree bark infringes claim 1 of the patent. However, the tree bark must be glued to the circumferential surface for the wheel to infringe claim 2, and must be tied to the circumferential surface to infringe claim 3.

Fred's invention is commercially successful. His profits attract a competitor, Betty. Betty copies Fred's product despite the existence of the patent. Fred sues Betty for patent infringement. Betty responds by attacking the validity of the patent. In litigation, the costs involved are of a higher order of magnitude than the cost of obtaining the patent. Accordingly, Betty conducts a search that is more thorough than the search previously conducted by the Examiner in the Patent Office and that costs her more than Fred spent obtaining the patent. Her validity search aims to locate relevant prior art that falls within the scope of any of the claims of the patent.
Betty’s validity search is successful. She finds an early wheel that is made not of stone, but of wood. These early wheels were constructed by cutting circular cross-sections from trees. These circular cross-sections can then serve as wheels. As the tree had bark on its cylindrical surface, the resulting wheels have bark applied to their circumferential surfaces. Claim 1 of the issued patent reads on these early wheels. Thus, claim 1 lacks novelty and is invalid. Claim 1 would have been valid if it had specified that the circumferential surface is made from stone, as this would have prevented claim 1 from reading on the early wooden wheels. However, without some limitation that prevents it from reading on prior art wheels, claim 1 is invalid.

Betty attaches the tree bark to her wheels by glue. She argues that claim 2 of the issued patent is also invalid for lack of novelty on the basis that bark is glued to the underlying surface of a tree by sap and, consequently, that claim 2 reads on the early wooden wheels that are hewn from trees. However, a botanist employed at a local arboretum testifies that bark is not retained on the underlying surface of the tree by sap. Based on this expert testimony the court finds claim 2 to be valid – claim 2 does not read on the early wooden wheels as bark is not held onto the underlying surface of a tree by the sap. After construing claim 2 to determine its scope, the court finds that Betty’s wheel includes all of the elements recited by claim 2 and accordingly infringes claim 2 and the patent.

Not to be defeated, Betty searches for new ways of attaching tree bark to the circumferential surface of a wheel. She discovers two approaches. The first approach involves adding spikes to the circumferential surface of the wheel. Bark that is pressed against the circumferential surface of the wheel is held in place by these spikes that pierce the bark. As this wheel does not appear to include the features of claims 2 and 3 of the patent, and claim 1 is invalid, it appears that this new device does not infringe Fred’s patent. Note that if Fred had been aware of the wooden wheel prior art – in which wheel are cross-sections hewn from trees – then he might have written claim 1 - call it claim 1' - as follows:

1'. A wheel for reducing slippage, the wheel comprising a circumferential surface substantially made of stone;
rough-surfaced tree bark applied to the circumferential surface.

Claim 1' so written would not have been invalidated by the wooden wheel prior art as the circumferential surface of these wheels is made from wood and not from stone. Further, claim 1' would have been infringed by Betty's spiked wheel.

While a wheel having spikes on its circumferential surface seems to avoid the protection afforded by the claims, Betty is more excited by her other approach. She has discovered that the bark taken from a specific species of tree — call it a rubber tree — has a high coefficient of friction. This bark is relatively thin and smooth when compared to the bark that Fred describes in his patent. Unlike the rough-surfaced tree bark taught by the patent, this smooth bark cannot be held onto a circumferential surface by spikes as the spikes tend to pierce right through the bark. Betty wants to glue this rubber bark to the wheel. If she is sued by Fred for patent infringement, she plans to argue that while the rubber bark is rougher than a stone circumferential surface of a wheel, it is too smooth to accomplish the object of Fred's patent — viz. a substantial reduction of slippage. Instead, the rubber bark accomplishes this purpose in another way — by having a high coefficient of friction. In response, Fred is likely to argue that Betty's wheel falls squarely within the wording of the claim. It may represent an improvement that Betty can patent, but this improvement is to a base invention that Fred invented.15

What Fred and Betty are doing in the above-described example can be understood from a mentalist perspective on language in which the claim expresses a concept of the invention. When grasped, this concept enables embodiments of the claimed invention to be identified. From a mentalist perspective, the real invention is something that is abstract which may be embodied in a number of different forms. Fred does not want to limit his patent to the mere embodiment that he has built. Instead, he wants the patent to extend to any embodiment of the invention. Thus, he must determine the most

14 Say an object is resting on a horizontal surface. The object is subject to a normal force due to gravity that pushes the object against the surface. This normal force is perpendicular to the surface and is balanced by an equal and opposite force that the surface exerts on the object. The coefficients of friction of the object and the surface can then be multiplied together and to the normal force to calculate the frictional force resisting sliding movement of the object along the surface.

15 If Betty were to patent the wheel/rubber bark combination, and if this combination was found to infringe Fred's patent, then during the lifetime of Fred's patent, neither Betty nor Fred would be able to practise the
abstract concept of the invention, and must define this abstract concept in the broadest claim in his patent, so that anyone who makes, uses or sells something falling under this concept will be liable for patent infringement. A skilled reader of the claim will grasp the concept of the invention and will be able to identify embodiments of the invention that fall under the concept of invention expressed by the claim, thereby avoiding infringement.

In practice, it may be very difficult if not impossible to determine the most abstract concept of the invention. In the example, Fred had no reason to think that requiring the circumferential surface of the wheel to be made of stone would be a necessary element of the concept of the invention. Yet without this element, the abstract concept of the invention expressed by the first claim was too broad and could not stand. Recognizing this difficulty, the courts have allowed many claims to be included in the patent so that the inventor has as many tries as there are claims at correctly identifying the concept of the invention. In this example, however, the results were far from satisfactory for Fred in that he was left with two claims that could be avoided if a way was found to attach the tree bark to the circumferential surface of the wheel without gluing or tying it.

The first step in drafting the claims is to break the invention down into elements that are individually necessary and collectively sufficient conditions for any embodiment of the invention. These elements then form the marks of the concept of the invention defined by the broadest claim. Fred's predicament reveals how fatal and how easy a mistake in choosing these elements can be. Without knowing of the wooden wheel prior art, Fred was not going to choose elements that were sufficient to define the invention over this prior art.

Fred's predicament raises the issue of whether it is ever possible to successfully analyze an invention — to break it down into elements that are individually necessary and collectively sufficient to determine any embodiment of the invention. Beyond this predicament, however, there are the more general questions of whether the invention should be conceived of as an abstract entity at all and of how the invention should be thought of if not as an abstract entity. Given that the invention is defined by the claims,
these questions are tied up with the related questions of whether there is some abstract meaning of the claims, and whether this abstract meaning of the claims can be determined by individually necessary and collectively sufficient elements. These are questions about the nature of language that Ludwig Wittgenstein considers.
CHAPTER THREE: AN EXTERNALIST PICTURE OF CLAIMS

3.1: A Mentalist Picture of Claims

In the first paragraph of the Philosophical Investigations, Wittgenstein describes a mentalist picture of language:

“The individual words in language name objects - sentences are combinations of such names. - In this picture of language we find the roots of the following idea: Every word has a meaning. This meaning is correlated with the word. It is the object for which the word stands.”

For the mentalist picture of language to work, the rules that determine the meaning of the word must determine the entire use of the word. That is, the rule must determine all of the objects with which the word is correlated. Thus, these rules must somehow express the essential features of the world. These essential features are mirrored in our language and our thought, which must therefore provide a "unique correlate, picture, of the world."\(^{18}\)

According to a mentalist picture of language, inventions can be broken down into essential elements. This is possible in part because the invention depends for its operation on laws of nature. These laws of nature provide a dynamic picture of the world, allowing us to predict how different elements will interact, thereby allowing us to identify the essential elements of the invention. Patent claims can then be written using the words that name the essential elements of the invention. When grasped, the meaning of the claims allows all embodiments of the claimed invention to be identified.

In the case of a wheel, the laws of physics determine the conditions in which rolling motion is advantageous. Say that the wheel has a central bore for supporting an axle. Then the distance from this central bore to the circumferential surface of the wheel should be substantially uniform – the radius of the wheel should be constant. If the distance from this central bore to the circumferential surface of the wheel is not substantially uniform, then the axle will dip and rise as the wheel moves through a complete rotation, thereby reducing wheel efficiency. Further, there should be substantially no slippage between the circumferential surface and the support surface.

\(^{17}\) Philosophical Investigations, supra, note 3 at paragraph 1.

\(^{18}\) Ibid at paragraph 95.
along which the wheel travels. If the circumferential surface of the wheel slips on the support surface, then some of the energy of the rotating wheel will be lost.

Before Fred's invention, the correlate picture of wheels had not been fully explored. As described above, the laws of physics coupled with the human objective to conserve energy imply that there should be no slippage between the circumferential surface of the wheel and the support surface along which the wheel travels. Thus, this information existed in the correlate picture of wheels provided by our scientific and technological language, but had not yet been consciously grasped. Through exploring this correlate picture of wheels, Fred gained an improved grasp of the laws of physics as they relate to wheels. That is, he recognized that a general characteristic of efficient rolling motion is a lack of slippage between the wheel and the ground. To the extent that existing wheels failed to inhibit slippage between the wheel and the ground, Fred recognized that these wheels were inefficient. Once he had hit upon the idea of attaching tree bark to the circumferential surface of the wheel to reduce slippage, his idea of the applicable physical principles — rough surfaces are more resistant to sliding than smooth ones — enabled him to abstract from his specific solution to a general concept of the invention as expressed in the claims. Specifically, his idea of the applicable physical principles enabled him to identify the elements that must be found in any embodiment of the invention. Initially, in his two broadest claims these elements are named “slippage reduction means” and “roughened surface”. Once the elements have been identified and suitably named, the concept of the invention can be expressed in a claim.

3.2: The Mind of the Inventor

3.2.1: Fred’s Mind

Fred's invention involves adding an element - tree bark or some equivalent thereof - to the circumferential surface of a wheel. To define his invention, he needs to come up with a name for this element. The names he comes up with vary in scope from the broad “slippage reduction means” to the narrow “rough-surfaced tree bark”. “Slippage reduction means” names a broad class of elements. The members of this class of elements can be determined in part by looking at the words in the claim that stipulate that the slippage reduction means is applied to the circumferential surface of a wheel. Thus, each member of this class of elements must reduce slippage of the wheel when applied to its circumferential surface. However, this falls far short of determining all members of the class of elements named by “slippage reduction means”. Fred could
have written this claim having developed only an appreciation of problems with existing wheels – they slide – without having devised any solution. To determine the elements named by “slippage reduction means” we need to look at the specific elements that Fred has identified.

What is true for “slippage reduction means” is, under a picture of language in which words name objects, true for words in general. In the case of words like “bark” we are able to look up definitions or verbal explanations of the word in a dictionary. However, these words must themselves be explained. This process can continue for a while, but verbal explanations come to an end somewhere. At some point it will be necessary to define words by pointing to the things with which the word is correlated.

In what sense can Fred be said to have identified all of the elements that can be added to the circumferential surface of the wheel to implement his invention? He has come up with a series of names of varying breadth, but it seems unlikely that the entire use of each of these names came before his mind when he came up with them. Equally, when skilled workers read the claim, the whole use of these names will not come before their minds. Instead, whenever a new use is suggested, they will have to decide whether the name can be so used. If this use was not in Fred’s mind when he drafted the claim, but a court subsequently finds that the new use does fall within the meaning of the claims, then the scope of the invention is not determined by what is in Fred’s mind.

Wittgenstein makes a similar point with respect to the word “cube”:

“When someone says the word “cube” to me, for example, I know what it means. But can the whole use of the word come before my mind, when I understand it in this way [emphasis in the original]?“  

Fred uses the expression “slippage reduction means” as he might use the word “cube”. He has thought of a couple of applications of “slippage reduction means” and he points to these in his patent, but he relies on unspecified rules to have “slippage reduction means” identify the essential nature of all the things that can be added to the circumferential surface of his wheel to reduce its slippage. Thus, Fred’s thought does

\[19\text{ Ibid. at paragraph 139.}\]
not provide some correlate picture or mirror of the world that reflects the essential nature of invention.

This is also apparent from Fred’s misadventures in patent claiming. In the variants of his invention that he discloses, the wheels, excepting only the attached bark, are made of stone. Due to the wooden wheel prior art – the wheels hewn from trees – this feature of Fred’s wheels turns out to be important in distinguishing his invention from the prior art. However, without knowing of the wooden wheel prior art, Fred would not think that the stone composition of his wheels was an important feature. It may be Fred’s invention, but the features of this invention are determined as much as by what is in the world as by what is in Fred’s mind.

3.2.2: Betty’s Mind
Recall that Betty discovered that wheel slippage could be reduced when the bark of the rubber tree was attached to the circumferential surface of a wheel despite the rubber bark being too smooth to provide this result. If her invention is limited to applying this bark to the circumferential surface of wheels, then she might draft a claim as follows:

1. A wheel for reducing slippage, the wheel comprising a circumferential surface substantially made of stone; and rubber-tree bark applied to the circumferential surface.

It is likely that there is some intra-species variation in rubber trees. There may also be trees that are closely related to rubber trees whose bark may share some of the characteristics of rubber tree bark. Further, there may be no sharp demarcation between these different species of tree. Similar to Fred, Betty has to rely on some unspecified rules to have “rubber-tree bark” identify the essential nature of all of the things that can be added to the circumferential surface of her wheel to reduce its slippage.

Betty realizes that there may be other substances that provide a similar result and wants to cover these other substances as well. Her predicament is quite different from Fred’s in that Fred’s invention, or at least the embodiments of his invention of which he is aware, involves the application of known principles – it is known in Fred’s time that
roughened surfaces resist slippage more than smooth ones. However, no one else in Betty’s time has worked out the idea of a coefficient of friction or that some substances may resist slippage more than others despite being smooth. This does not mean that they are not aware of this at some level, as they may have slipped on icy surfaces, but that they have never thought about this phenomenon or its potential applications in the same way that Betty has, and have never thought of all smooth surfaces that resist slippage as having something in common that distinguishes them from other surfaces.

Having drafted the above claim, she thinks about how a competitor might try to avoid the protection afforded by the claim. Such a competitor might think that if rubber-tree bark provides this function there may be other substances that also provide this function, which other substances could be discovered and used to circumvent the protection afforded by the claim. Betty decides to look for some of these other substances herself before drafting the patent application, not because she thinks that she can find them all, but because she thinks that if she finds at least a couple, she may be able to discern something that all such substances have in common, which will help her in providing effective claim coverage. Say she discovers a plant having slippage resistant leaves for catching flies. These leaves perform the same function as the bark from the rubber tree. Examining the leaves and the bark of the rubber tree, she sees that both have small but elongated pores that extend in parallel lines. She looks for, but does not find similar pores in other kinds of bark or leaves. Taking a chance, she redrafts her broad claim as follows:

1. A wheel for reducing slippage, the wheel comprising a circumferential surface substantially made of stone; and organic material applied to the circumferential surface, the organic material having a plurality of laterally extending pores.

In this case, Betty has certainly not thought of the whole use of the term “organic material having laterally extending pores”. She certainly has not thought of the range of variants of her invention that will be caught by her claim. Indeed, she has drafted her claim because she cannot think of all of these variants. If she could think of them, then she might be able to identify them more precisely. Betty does not even know that the feature she has identified is important to the operation of her invention.
The notion that the invention is an abstract entity, which abstract entity is also the meaning of a carefully drafted claim, does not fare well in the foregoing account of Fred’s and Betty’s efforts to define their inventions. Betty’s broad claim does not reflect an abstract concept of the invention that she has in our mind. Instead it is based on observed features of two slippage-resistant materials. She does not know that these observed features have anything to do with the slippage-resistance character of the materials, let alone whether the observed features are necessary features of slippage-resistant materials generally. If Fred had known of the wooden wheel prior art, then he would have been able to include the requirement that the wheels be made of stone to avoid this prior art, and broad claims reciting “slippage reduction means” might have been allowed. Would the abstract structure underlying this claim extend to a wheel having slippage resistant leaves applied to its circumferential surface? Clearly, Fred did not think of this possibility when he drafted the claim. Equally clearly, however, this is not the relevant test as Fred also did not think of all means of roughening the circumferential surface of the wheel – such as by applying alligator hide thereto – when he drafted the claim, yet one can say that Fred meant to cover the alligator hide wheel in a way that he did not mean to cover the rubber sap wheel. That Fred meant to cover means of reducing slippage that did not involve roughening the surface of the wheel seems clear, or he would have limited the broadest claim to having a roughened surface applied to the circumferential surface of the wheel. Thus, what Fred intended to achieve by using the claim is not determined by any abstract structure underlying the claim.

3.3: Language in Forms of Life

In the first paragraph of the *Philosophical Investigations*, Wittgenstein also rejects the idea that we can get behind or below our use of language to ground it in some abstract structure. To point out some shortcomings in this view of language, Wittgenstein describes a shopping trip involving a piece of paper on which is written “five red apples” being handed to a

“shopkeeper, who opens the drawer marked ‘apples’; then he looks up the word red in a table and finds a colour sample opposite it, then he says the series of cardinal numbers - I assume that he knows them by heart – up to the word “five” and for each number he takes an apple of the same colour as the
sample out of the drawer. – It is in this and similar ways that one operates with words.”

In this example, what the word "five" means is not at issue; all that matters is the way that the word "five" is used. Further, while both "red" and "apples" might be said to have a meaning, the process of using each is so different that it is difficult to see what advantage there is in using the same word, meaning, to refer to some ultimate knowledge underlying both "red" and "apples" that grounds the use of both.

In the foregoing example, Fred and Betty are involved in a complex interaction with each other and with the external world, in which words are used in a way that is both central and highly idiosyncratic. Fred starts the game by trying to define his invention. He knows he may get it wrong and so makes several attempts by writing several different claims. In the end, the definitions he formulates are flawed, perhaps fatally, by his lack of knowledge of the prior art. Betty too is playing the game. Her innovative efforts are likely to be influenced by a desire to circumvent the protection afforded by the definitions Fred has constructed. The role that language plays in their interaction is central because it determines so much of their behavior. This role is idiosyncratic because they not only use language to communicate, but also use it to restrict each other's behavior and to direct their own behavior. For example, Fred uses language to restrict Betty's behavior by defining what Betty may not use, while Betty uses the same language to direct her efforts to circumvent Fred's efforts to restrict her behavior. Fred is driven to improve his understanding of the technology and its history in order to effectively restrict Betty's behavior, while Betty is also driven to improve her understanding of the technology to circumvent the protection afforded by Fred's claims. Thus, the language game that Fred and Betty are playing is inextricably connected with the nature of the technology, the historical development of the technology and the future development of the technology. In fact, Fred and Betty are playing at least two different language games drawn from intersecting forms of life – one language game regards wheels, while the other language game introduces terms for improvements to wheels that are selected to exclude others from using these improvements.

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20 *Ibid*, at paragraph 1.
It is in paragraph 19 of the *Philosophical Investigations* that Wittgenstein first uses the expression “form of life” to refer to the context in which we use language. However, this expression relates back to his earlier discussions of instances of language use:

“It is easy to imagine a language consisting only of orders and reports in battle. - Or a language consisting only of questions and expressions for answering yes and no. And innumerable others. - And to imagine a language is to imagine a form of life.”

Throughout the *Philosophical Investigations* Wittgenstein describes instances of language use – forms of life – to show how language is part of interaction with others and with the external world, rather than necessarily relying on some notion of meaning. He uses the expression “language game” to refer to these instances and to emphasize that speaking a language is part of an activity or form of life. The mentalist conception of language relies on some abstract structure or meaning underlying our use of language, which must be grasped for someone to correctly use the language. By focusing on specific forms of life and the language games included therein, Wittgenstein does not so much deny this conception of language, but rather shows that it does not apply to many of the ways in which we habitually use language. However, this is not to say that our use of language can be completely subjective.

In part II of the *Philosophical Investigations*, Wittgenstein considers whether it makes “sense to say that people generally agree in their judgment of colour?”21 He asks what it would be like for people not to agree in the way in which they use colour terms. If people did not agree on how to use colour terms, then no one would be able to learn these words as these words would not exist. That people do agree on how to use colour terms is a fact about people and about the forms of life in which these colour terms are used. The meaning of these colour terms cannot be separated from these facts. For us to have words at all, we must, in large measure, agree in our forms of life. Thus, it does not make sense to ask if people agree in their use of the word “blue”, say, as if they did not agree, we would not have the word “blue” and would therefore be unable to ask the question.

From a mentalist view of language, asking if people generally agree in their judgment of colour makes sense. From this perspective, the word “blue” denotes a concept of

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21 *Ibid* at 226e.
blueness, which has been grasped by those who have acquired the use of the word. It is possible then that people might share the same concept of blueness, but due to some difference in their perception disagree as to whether something is blue or not. Further, this shared concept might provide the basis for agreement in the use of the word “blue”. However, there is nothing that we can positively point to that is this concept. Our language suggests to us that such a concept must exist so that when we grasp the concept of a word, we are able to use the word. “Where our language suggests a body and there is none: there we should like to say is a spirit [something mental].”\textsuperscript{22} If someone were unable to speak, we might say that they lacked the requisite mental capacity. But all we see is that they do not speak. Instead of looking for something mental that underlies our speech, we should rather end the explanation where we still have something at which to point – our tendency to use words in the same way. This grounds language usage in a highly general fact of life. More generally, this grounds language in a fact of a form of life, as the type of agreement that emerges differs in different forms of life. It also removes the distinction between being able to use language and being able to navigate in the world – the fact that there is agreement in how to navigate in the world makes it possible to express this agreement using language.

Wittgenstein also raises this point in part I of the \textit{Philosophical Investigations}:\

“‘So you are saying that human agreement decides what is true and what is false?’ – It is what human beings say that is true or false; and they agree in the \textit{language} they use. That is not agreement in opinions, but in form of life. If language is to be a means of communication there must be agreement not only in definitions, but also (queer as this may sound) in judgments. This seems to abolish logic, but does not do so. – It is one thing to describe the methods of measurement, and another to obtain and state results of measurement. But what we call ‘measuring’ is partly determined by a certain constancy in results of measurement.”\textsuperscript{23}

The foregoing passage distinguishes between agreement in opinions and agreement in forms of life. When we put our opinions into language, we can be right or wrong. Whether we are right or wrong is not, in general, a function of human agreement. Language, however, requires human agreement as without certain highly general facts

\textsuperscript{22}/bid at 36
of life – such as the fact that when different people measure something there is substantial agreement about the correct measurement – we would not have the terminology available to us that we do.

3.3.1: When there is no agreement – the case of Betty’s invention

Recall that Betty had discovered that rubber-tree bark and that the leaves of a certain fly-catching plant provided slippage-resistant surfaces. Say that before she files her patent application, Betty discovers that the sap of the rubber tree can be cured into a cylindrical surface that is both smooth and slippage resistant. Unlike the bark of the rubber tree or the slippage resistant leaves, the cured sap does not appear to have elongated pores. She cannot discern anything that all three of these substances have in common other than the common function that each provides of resisting slippage. In the end, she redrafts her broadest claim as follows:

1. A wheel for reducing slippage, the wheel comprising a circumferential surface substantially made of stone; and a smooth slippage reduction means applied to the circumferential surface.

Unlike Fred, who recites “a slippage reduction means” in his broadest claim in order to provide the widest possible protection and not because he cannot find a common element in all embodiments of his invention, Betty recites “a smooth slippage reduction means” in her broadest claim because she cannot find any name to refer to the common element in all embodiments of her invention. In order for her to be able to use this name at all, however, she must prepare the reader of her patent by disclosing actual cases of “smooth slippage reduction means” that can be used. Without this preparation, using the expression “smooth slippage reduction means” is akin to telling someone who knows nothing about chess that a chess piece is called a king. The explanation that a chess piece is a king

“only tells him the use of the piece because, as we might say, the place for it was already prepared. Or even: we shall only say that it tells him the use, if the place is already prepared.”

23 Ibid at paragraph 241
24 Ibid at paragraph 31.
Betty must prepare a place for the expression "smooth slippage reduction means" before she is able to use this expression in the claims. Betty's ability to do this is limited by the available knowledge of the applicable scientific principles. If she were to write the claim today she might require the circumferential surface of the wheel to have a high coefficient of friction. The frictional force preventing sliding of the wheel is the product obtained by multiplying the gravitational force, which presses the wheel into the ground, by the coefficient of friction. However, neither Betty nor any of her contemporaries have knowledge of the laws of physics on which the coefficient of friction depends, and are thus unable to use this concept.

In Betty's time there is no agreement in judgment regarding slippage-resistant materials. This fact is reflected in the fact that the vocabulary of her society does not include terms such as coefficient of friction. In the absence of such agreement, the scope of Betty's invention will not stretch much beyond the actual variants she has discovered, as there will be no agreement in judgment or language game for grouping the variants discovered with other variants of the invention. Where there is agreement in judgment in the field of an invention, then the scope of an invention may extend far beyond the particular variants of which the inventor has thought.

3.4: The Patent Claim Language Game
Fred and Betty are participants in a number of different forms of life. One form of life regards wheel technology. It is a fact of human life that we agree on what is desirable in a wheel.\(^{25}\) As stated above, a wheel should be as close to being perfectly circular as possible, and an axle supported by the wheel should be fitted as close to the center of the wheel as possible. It is also a fact of human life that agreement can change. In the case of science or technology, one person may have an insight regarding how our science or technology may be improved. Initially there is no agreement regarding this potential improvement, but when it is communicated to others, the insight may be incorporated into the agreement, thereby changing the agreement. This agreement in form of life allows us to have the word "invention". Thus, before Fred's invention the features that humans agreed were desirable in a wheel did not include the feature that in operation there should be as little slippage between the circumferential surface of the

\(^{25}\) This is not to say that we agree on everything about wheels. People may differ, for example, on what diameter wheels should be.
wheel and the support surface (the ground) along which the wheel travels as possible. However, after Fred publishes his invention, this feature becomes part of what we agree to be desirable in a wheel. The form of life regarding wheels involves our interaction with the natural world when we use wheels, and includes the fact that our experience of this interaction is sufficiently similar that we substantially agree about what is important for wheels to operate. This substantial agreement makes possible language regarding wheels, which is a part of this form of life.

Fred and Betty are also participants in another form of life—patent law. There must be substantial agreement regarding an inventor’s contribution to the art, as without this substantial agreement we would not have the word “invention”. The task of the inventor or patent agent is to discern this agreement and express it in the claims in a way that competitors cannot circumvent. With Fred’s invention, this involves both using the language game regarding wheels and adding elements to this language game to accommodate changes in our practice. The language game regarding wheels must be used to define how the improvement interacts with that which was previously known. To stop others from circumventing the protection afforded by the claim, there must be agreement that the previously known elements recited in the claim are essential to the operation of the wheel as otherwise a competitor can avoid infringement by omitting any known element required by the claim. The improvement must be defined so that it catches every way in which the improvement can be implemented. For the claims to be valid, there must be agreement that no item of the prior art includes all of the elements recited in the claim.

Claims define inventions by treating the inventions as composite objects and then breaking them down into elements that are listed in the claims. In the *Philosophical Investigations*, Wittgenstein points out that there is no absolute sense of what is simple or composite, nor is there anything absolute about the way we break down an allegedly composite thing into simpler elements. As there is no absolute sense of what is simple or composite, the particular way we choose to break something down into simpler elements depends on the language game we want to play.

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26 *Philosophical Investigations, supra*, note 3 at paragraph 47
In response, it might be argued that the periodic table of elements provides an absolute way of breaking down a composite object into elements. Presumably, the stones that Fred and Betty use to make wheels are composed of different minerals. These minerals could have been chosen as the simpler elements into which the composite wheel is broken down. However, this way of breaking wheels down into elements does not play the role that Fred wants it to play in the form of life. That is, Fred needs to distinguish his invention from prior wheels using the elements into which he has broken down the invention. For his invention to work, the circumferential surface must be rough regardless of the material of which it is constructed. Some elements may work better for this purpose than others. However, other elements, such as carbon, may work in some forms—tree bark—but not in others—oil. Thus, the chemical composition of Fred's wheel cannot on its own distinguish this wheel from what was known or obvious, or from what does not work.

The patent claim language game that Fred wants to play is connected to the language game of wheels. Specifically, Fred wants to be able to stop others from using his improved wheel. To do so, Fred must come up with a definition of his improved wheel that extends to all possible versions of the wheel, and which does not extend to anything that does not work or is known or obvious. As there is agreement between those engaged in the form of life involving wheels as to what features are desirable for wheels, this form of life is able to support a language game. Fred will rely on this language game to provide the known elements of his definition of his improved wheel. He determines that the known element that provides the most useful player for the patent claim language game is the circumferential surface. As wheels are generally round and have circumferential surfaces, this limitation is not unduly limiting but instead limits the definition appropriately to circular, hence operable, wheels. As a claim must not only list the elements, but also describe the interaction of the elements, the known element should be chosen with a view to describing this interaction. In the case of Fred's wheel, the circumferential surface is an effective choice for the known element as it is the circumferential surface that has the tendency to slip that must be countered.

A feature that the inventor adds to a previously known device cannot have been previously known, at least in connection with that device. Thus, there may have been no generally experienced form of life with regard to this element, nor any agreement
providing the basis for a language game regarding this element. However, the wheel itself was once a technological innovation about which there could have been no initial agreement as only the innovator would have known of the wheel. The agreement that now exists regarding wheels has developed through our interaction with wheels and with each other. It is a fact of our experience regarding technology that agreement emerges regarding what is functional.

"And if things were quite different from what they actually are...this would make our normal language games lose their point.-The procedure of putting a lump of cheese on a balance and fixing the price by the turn of the scale would lose its point if it frequently happened for such lumps to suddenly grow or shrink for no obvious reason....

What we have to mention in order to explain the significance, I mean the importance, of a concept, are often extremely general facts of nature: such facts are hardly ever mentioned because of their great generality."

Thus, even if there can be no agreement regarding innovations, agreement will eventually emerge if and when the innovation is adopted into practice.

The goal of the patent agent – the goal of Fred in the foregoing example – is to use language in the claim that will be consistent with whatever agreement regarding the new technology eventually emerges. Until Fred recognized this problem, no one in his society may have realized that wheel slippage was a systematic problem, or have realized that this problem could be mitigated by roughening the circumferential surfaces of wheels. In this case, there could have been no agreement regarding either the problem or the solution. It is a fact of life that after one person recognizes a problem with a technology others will often agree that there is a problem. It is also a fact of life that after one person proposes a solution to a problem others will often agree that the proposed solution works. Fred has recognized a problem and proposed a solution. For his patent to be valuable, others must agree with both his recognition of the problem and with the solution he proposes. If this agreement emerges then this renders possible the

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27 Some inventions involve applying an element that is well known in other contexts in a new ways. In the case of such inventions, the place for the name may be already prepared such that as soon as the inventor mentions applying the element in the new context, a skilled reader will understand the full range of application of the element in the new context. Such an invention seems analogous to a metaphor in which everyone understands how the word that is used metaphorically is to be understood in a new context because of parallels with the literal meaning of the word.

28 Philosophical Investigations, supra, note 3 at paragraph 142 and at page 56e.
use of the language of the claim to point to this agreement. However, for the claims to work as intended the person drafting the claim must correctly anticipate the agreement that emerges.

To do this, the patent agent must be able to anticipate what agreement is likely to emerge regarding the functionality of the invention. With the aid of the inventor or another having relevant skill, the patent agent is often able to do this. The patent agent considers both the prior art and inoperable subject matter on the one hand, and variants of the invention on the other, and determines features of the latter that are not found in the former. Using these features, the patent agent then writes claims that serve as a map for covering variants of the invention while avoiding the prior art and inoperable subject matter. It is a highly general fact of life that others will agree with the patent agent regarding what is a variant of the invention and what is prior art or inoperable subject matter. Beyond this, however, it is a remarkable fact that the features of the invention that are recited in the claim will often be seen to be present in variants of the invention that the inventor did not initially think of. Accordingly, assuming the map is drawn well by the claim, others’ judgments regarding what is the invention will be consistent with what is expressed in the claim.

To illustrate this, recall Fred’s initial claim, and the claims of his issued patent. Others agreed with him regarding the problem he recognized, and also agreed with him that his solution was at least a partial one. However, instead of steering a course between the prior art and variants of the invention, his broadest claims were wrecked on the prior art. His narrow claims remained further from the prior art than they needed to be in that there were variants of the invention that he could have claimed that he did not in fact claim. Put another way, he did not do a good job of anticipating the eventual agreement that emerged regarding the prior art.

29 It is not uncommon that after a patent agent has prepared and filed a patent application, the inventor will come up with a completely new variant of the invention that she had not thought of before. In these situations, the new variant will often include all of the features recited in the claims, such that these variants are covered even though they seem to be different and possibly preferable. This experience can readily be accommodated within a mentalist view of the invention and language. The inventor and the patent agent had already succeeded in identifying the essential elements of the invention. It can also, although less obviously, be accommodated within an externalist view of language that recognizes how much our experience of the world, and our ways of seeing things as like or unlike, has created agreement in our judgments. For the most part, we are not conscious of this agreement in our judgment; however, it is reflected in our language and is invoked when we use the words of our language.
Fred initially chose the expression "slippage reduction means" to signify the inventive element. This expression proved too broad during prosecution of the patent application, as did the expression "roughened surface". One way of putting this is that whatever agreement eventually developed regarding the inventive element of Fred's invention, it became apparent during prosecution of the application that this agreement would be contrary to using either of the expressions "slippage reduction means" or "roughened surface" to refer to the inventive element of Fred's invention. This became apparent, because the examiner found rough-surfaced wheel prior art. Just as it is contrary to our shared agreement on which the use of colour terms depends to use "blue" to refer to a range of colors including green and purple, it is or will be contrary to the shared agreement regarding wheel technology to use the expressions "slippage reduction means" or "roughened surface" to refer to the inventive element of Fred's invention as these expressions also extend to previously known devices.

The claims that Fred ended up with in the issued patent turned out to include a claim reciting "tree bark" that was too broad to stand in view of certain prior art – the wheels hewn from logs that still have their bark – and claims requiring the bark to be tied or glued to the circumferential surface of the wheel, which ultimately did stand. These valid claims turned out to be overly conservative in view of the agreement that emerged, however, making it easier for others to circumvent the protection afforded by the claims.

Without the language game of Newtonian mechanics, it is difficult to see how Betty will come up with language that will be consistent with whatever agreement eventually emerges regarding her invention. Recall that she drafted her first claim as follows:

1. A wheel for reducing slippage, the wheel comprising a circumferential surface; and a smooth slippage reduction means applied to the circumferential surface.

This claim is deficient in that it does not cover embodiments of Betty's invention in which a rough material having a high coefficient of friction is applied to the circumferential surface of the wheel. The expression "smooth slippage reduction means" cannot be
used to refer to a rough material. Thus, this claim might not read on modern tires, which, having treads, are rough. However, modern tires arguably embody Betty's invention. This claim may not even read on the embodiment of the invention that relies on bark from the rubber tree as this surface is also rough. Yet Betty needs to include the word "smooth" in the expression "smooth slippage reduction means" as without this word the claim would be invalid for reading on both Fred's invention and also on the prior art to Fred's invention.

Ultimately, Betty will need to include multiple independent claims to catch all of these embodiments of the invention that do not seem to her or to any of her contemporaries to have any one feature in common. Thus, she will have to include the following claim in the patent to cover the bark embodiment of her invention:

A wheel for reducing slippage, the wheel comprising
a circumferential surface; and
bark of the rubber tree applied to the circumferential surface.

Note that if someone subsequently discovers a tire beast that has a hide resembling a contemporary tire tread, and uses the hide of this animal to cover the circumferential surface of the wheel, then this may not infringe her patent. Yet arguably it would be based on her invention. Betty may be unable to write a claim that would stop anyone from using a rough material having a high coefficient of friction that she had not discovered when she wrote the claims.30

That there is agreement in judgment regarding what things are alike in relevant respects does not necessarily mean that this agreement is based on some common features that all of the things that are alike will share. It is true that agreement is often based on common features that all of the things that are alike share. This is what leads Betty to search for a feature common to all slippage-resistant surfaces she has discovered. She hopes that the agreement that finally emerges will focus on this feature. However, sometimes no such common feature will be found. For example, as far as I know surfaces that have a high coefficient of friction have no other feature in common. Despite this, a large measure of agreement in form of life has emerged regarding these

30Perhaps she has little reason to complain as her invention is itself based on Fred's recognition of a problem with prior art wheels, yet she has managed to avoid his claims.
surfaces. Thus, neither agreement in judgment in form of life nor a language game arising from the agreement need be based on common features.

Wittgenstein raises a similar point in connection with games and language use:

"Instead of producing something common to all that we call language, I am saying that these phenomena have no one thing in common which makes us use the same word for all,-but that they are related to one another in many different ways. And it is because of this relationship, or these relationships, that we call them all 'language'." 31

Wittgenstein uses the term family resemblances to refer to a concept all the members of which have no one thing in common but rather show a

"complicated network of similarities overlapping and criss-crossing: sometimes overall similarities, sometimes similarities of detail."

"I can think of no better expression to characterize these similarities than 'family resemblances'; for the various resemblances between members of a family: build, features, colour of eyes, gait, temperament, etc. etc. overlap and criss-cross in the same way. And I shall say that games [including language games] form a family."

This perspective is applicable on multiple levels, all of which point to problems in the mentalist picture of claims. First, as is the case for Betty's invention, it may be impossible to identify a common element that is found in all embodiments of Betty's invention and is not found in any of the prior art. Say, however, that Betty is able to come up with a name for all that is common in all embodiments of her invention and is not found in the prior art. Then as with the word "game", this does not indicate that there is an essence of the invention, but only that there was enough agreement among different people in the form of life of the invention for us to have such a word. Finally, this perspective warns against taking the same approach for all claims, as the roles that words play in different claims, or even at different points in the same claim, may be completely different.

According to an externalist view of technology, an invention can only be determined through interaction with the world and with others. The claims provide a map for steering between the prior art and variants of the invention. In other words, by writing
the claims the inventor purports to provide instructions to others on how to interact with the world to effect the invention without encroaching on the prior art. For the claims to be valid, they must lead others to variants of the invention without leading them to the prior art. Thus, the claims depend on agreement within the field of the invention. There must be agreement in judgment of what is the prior art and what is inoperable. In the case of an action for infringement, there must be agreement in judgment of whether the alleged infringement is a variant of the invention, and, provided the alleged infringement is a variant of the invention, of whether the claims lead to this variant.

Fred fails to protect his invention adequately because he fails to identify a relevant feature of his inventive wheel – that the inner portion of this wheel is made from stone. While undoubtedly part of his invention as he practices and describes it, this feature is not part of the invention as he claims it. From a mentalist view of technology, it is difficult to say that this feature is an essential aspect of the concept of his invention as it was not a feature he had to grasp in order to practice his invention and did not appear to relate to the advantages that he had thought his invention enjoyed over the prior art. From an externalist view of technology, it is much easier to see this feature as relevant to the invention. The invention can only be determined through interaction with the world and with others. The claims provide a map for steering between the prior art and variants of the invention. If there is prior art of which the inventor is unaware, and the claims lead others to encroach on this prior art, then the map is faulty and the claims are invalid.

It is difficult to say whether Betty has protected her invention adequately. From a mentalist view of claim language, she has not identified an essential feature of her invention by using the term “smooth slippage reduction means”. From an externalist view, her claims do not provide much guidance in pointing out variants of her invention. In the relevant contemporary linguistic community, there is considerable agreement about materials that have a high coefficient of friction. In contrast, all of her contemporaries lack the term “coefficient of friction” indicating the absence of any agreement about these materials. Given this absence of agreement, it will be much harder for her contemporaries to find other materials that reduce slippage in the same way that the materials she has identified reduce slippage. Accordingly, the claims that

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31 Philosophical Investigations, supra, note 3 at paragraph 65.
she has written may confer rights that are actually much more valuable than they appear to be to us. Her claims may also spur investigation into other slippage-resistant materials in order to circumvent her claims.

It might be argued that the failure of the mentalist account of claim language and technology in respect of Fred's and Betty's invention is not, in fact, a failure at all, as neither Fred nor Betty has correctly identified the essence of their respective inventions and thus should not be entitled to effective patent protection. According to this view, if the technology were completely understood, then language would exist for expressing this understanding, and it would be possible to draft effective claims directed to the essence of the invention using this language.

The foregoing argument depends on a mentalist view of scientific knowledge, and a view of technological knowledge as sufficiently akin to scientific knowledge as to share the mentalist character of the former. This view of scientific knowledge has been challenged by both Thomas Kuhn and Hilary Putnam. While these philosophers adopt very different approaches, they both argue that knowing the meaning of scientific terms requires interaction with an external community of skilled people and with the world. In the next chapter, I describe their arguments to make the case that a mentalist view does justice to neither scientific nor technological knowledge. Specifically, I argue that the practice of science can be better explained from an externalist than from a mentalist standpoint.
CHAPTER FOUR: AN EXTERNALIST PICTURE OF SCIENCE AND TECHNOLOGY

While both Hilary Putnam and Thomas Kuhn point out shortcomings in a mentalist view of scientific terms, their approaches are very different. Kuhn tries to describe actual scientific practice. His disagreement with the mentalist view is a result of this attempt at description as he finds that scientific practice cannot, in general, be described within a mentalist framework, as scientific knowledge cannot be reduced to mere laws or concepts. In contrast, Putnam does not look at actual scientific practice at all. Instead, he constructs an elaborate thought experiment involving a parallel world, Twin Earth, in order to show that a mentalist view of language cannot be correct. As their respective approaches are so different, each of these philosophers will be described separately. Based on these separate descriptions, separate arguments are then made for the externalist view of technological terminology.

4.1: Kuhn's externalist picture of science and technology

Perhaps the area in which the mentalist accounts of language use seem strongest is science. Scientific work seems to involve discovering extremely general laws of nature that, once grasped, allow scientists to explain and understand a wide range of different phenomena. These laws of nature are obtained by abstracting what is common from a range of phenomena with which a scientific discipline is concerned. Once they have been abstracted, the laws of nature provide a correlate picture of the world, such that one can have a scientific understanding of that part of the world with which the laws of nature are concerned simply by understanding the laws of nature and without interacting with the world or considering actual examples of the application of the laws of nature. The laws of nature provide a correlate picture of the world by predicting how one state of affairs will evolve. This correlate picture can be expressed in writing. Someone who reads and understands this writing will thereby gain a window into the brain of the writer. This window will reveal the correlate picture of the world that is held by the writer. When the reader grasps this correlate picture, she thereby understands something about the external world without having to interact with the external world. According to a version of this view, laws of science are cumulative. Over time, our scientific knowledge accumulates as these rules are refined to correspond more and more with actual laws of nature.
In order for this mentalist view of science and language to hold, the step of moving from the terms used in the laws of nature to the world must be completely unproblematic. That is, in order for knowledge of laws of nature to suffice to provide scientific knowledge of the external world, the application of words such as "force", "mass" and "acceleration" as used in the law $f = ma$, must be completely unproblematic, so that one without experience of the external world or examples of the application of the laws of nature will be able to make this step. The application of these words cannot depend on further explanation as all explanation must come to an end somewhere. That is, the meaning of these words – how we use these words – must ultimately depend on how we see alike the various instances to which we apply these words. In his book *The Structure of Scientific Revolutions*, Thomas Kuhn draws on examples from the history and practice of science to show that a picture of science as constituted by general laws of nature does not conform to either the history of science or to the contemporary practice of science. Instead, Kuhn, seeming to follow in Wittgenstein's footsteps, shows the priority of forms of life or paradigms over rules or laws of nature. Paradigms are a core of solved problems that are accepted as standard illustrations of the application of scientific theory by everyone in a scientific community. Newton's applications of his laws of solid mechanics provide examples of paradigms that seem to be reducible to generally applicable laws. However, this impression is misleading as to be able to use his laws of physics it is not enough simply to know them. Instead, one must have experience in using them, so that when one comes across a new problem it is possible to see likenesses between this problem and previously solved problems. Paradigms cannot be reduced to rules considered in isolation from their context.

Kuhn's argument that science is constituted by these paradigms rather than by the rules that can be abstracted from these paradigms rests on a number of observations drawn from his study of the history of science. He points out that the determination of shared paradigms is not the determination of rules, as determining rules

"demands a second step and one of a somewhat different kind. When undertaking it, the historian must compare the community's paradigms with each other and with its current research reports. In doing so, his object is to discover what isolable elements, explicit or implicit, the members of the community may have abstracted from their more global paradigms and deployed as rules in their research. Anyone who

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32 *Structure of Scientific Revolutions*, supra, note 4.
has attempted to describe or analyze the evolution of a particular scientific tradition will necessarily have sought accepted principles of this sort....But, if his experience has been at all like my own, he will have found the search for rules both more difficult and less satisfying than the search for paradigms. Some of the generalizations he employs to describe the community's shared beliefs will present no problems. Others, however, will seem a shade too strong. Phrased in just that way, or in any other way he can imagine, they would almost certainly have been rejected by some members of the group he studies. Nevertheless, if the coherence of the research tradition is to be understood in terms of rules, some specification of common ground in the corresponding area is needed. As a result, the search for a body of rules competent to constitute a given normal research tradition becomes a source of continual and deep frustration.  

While scientists will often not agree on the body of rules that define their research, they are much more likely to agree in their identification of a paradigm.

"Lack of a standard interpretation or of an agreed reduction to rules will not prevent a paradigm from guiding research. Normal science can be determined in part by the direct inspection of paradigms, a process that is often aided by but does depend upon the formulation of rules and assumptions. Indeed, the existence of a paradigm need not even imply that any full set of rules exists."  

According to a version of the mentalist view of science, science is cumulative as our knowledge of the scientific concepts underlying natural phenomena is refined. Kuhn rejects this cumulative picture of scientific knowledge. Instead, he presents a picture of science in which paradigms replace one another in a series of revolutions.

The ways in which students are taught science provides additional support for the view of paradigms rather than rules as central to scientific knowledge. It is a common experience among science students to read a chapter of a textbook and to understand it, but then to be unable to solve problems that are listed at the end of the chapter. The way that students eventually learn how to solve these problems is often the same.

"The student discovers, with or without the assistance of his instructor, a way to see his problem as like a problem he has already encountered. Having seen the resemblance, grasped the analogy between two or more distinct problems, he can

33 Ibid at 43 to 44.
34 Ibid, citing Polanyi, Michael, Personal Knowledge (Chicago, 1958) at chapters v and vi.
interrelate symbols and attach them to nature in the ways that have proved effective before. The law-sketch, say \( f = ma \) or some other symbolic generalization, is, I think, the main thing a student acquires by doing exemplary problems, whether with a pencil and paper or in a well-designed laboratory. After he has completed a certain number, which may vary widely from one individual to the next, he views the situations that confront him as a scientist in the same gestalt as other members of his specialists' group. For him they are no longer the same situations he had encountered when his training began. He has meanwhile assimilated a time-tested and group-licensed way of seeing.  

To adhere to a paradigm is not simply a matter of choosing an example that can be fruitfully applied in a context. Once a scientist has been indoctrinated into a particular way of seeing it is difficult and time-consuming to switch to a different way of seeing. Kuhn writes of older scientists who have successfully made the transition from a paradigm that governed their earlier scientific practice, to a later one, and are now unable to understand some of their earlier work that must be seen from their former perspective to be understood. They have lost the way of seeing that made it possible to explain their earlier work.

While rules or language games are not, on their own, constitutive of a paradigm, they often play a very important role in paradigms. In a first year physics course, students may spend a great deal of time learning how to use the law \( f = ma \). Knowing the law is trivial. What is important and much more difficult is to acquire the ability to use the law to solve different problems. This will often require students to be able to identify what it is in the problems to which \( f, m, \) and \( a \) apply – what in these problems is somehow alike what \( f, m, \) and \( a \) applied to in previously solved problems. There may be no common essence of \( f \) that is found in all instances in which \( f \) is applicable. However, through seeing the family resemblances of these different instances, or from some agreement that depends neither on family resemblance nor a common essence, students may recognize respects in which problems are alike.

While \( f = ma \) is only one formula, it can take many different forms, and the form it takes depends largely on the particulars of an application.

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35 Ibid at 189.
"It is not quite the case that logical and mathematical manipulation are applied directly to $f = ma$. That expression proves on examination to be a law-sketch or a law-schema. As the student or the practicing scientist moves from one problem to the next, the symbolic generalization to which such manipulations apply changes. For the case of free fall, $f = ma$ becomes $mg = m(d^2s/dt^2)$; for the simple pendulum it is transformed to $mg \sin \theta = -ml(d^2\theta/dt^2)$; for a pair of interacting harmonic oscillators it becomes two equations, the first of which may be written $ml(d^2s_1/dt^2) + k_1s_1 = k_2 (s_2 - s_1 + d)$; and for more complex situations, such as the gyroscope, it takes still other forms, the family resemblance of which to $f = ma$ is still harder to discover.\footnote{Ibid at 189.}

What the student or scientist are able to do is to recognize where different forms of $f$, $m$ and $a$ can be found in different situations, and so recognize what is fundamentally alike about these situations.

Similar to physicists, engineers learn how to use functions such as $f = ma$ to see new problems as like old problems. This involves solving problem after problem. In more advanced courses, these problems will increasingly be set in a technological context. This context imports considerations to the problem solving process that are not part of solving scientific problems.

While technology is often based on scientific knowledge, its purpose is to solve human problems and to satisfy human needs and wants. Technology deals with scientific knowledge only to the extent that it can help to solve these problems. Say the problem is how to keep food fresh. One solution to the problem involves recognizing that food will remain relatively fresh for longer if it is kept cold. Then the problem becomes how to keep food cold. This may be done for a while using an icehouse, in which ice that is collected in the winter is stored in an insulated building. Then the food may be stored in the icehouse and kept cool.

This solution is based on scientific knowledge. First, the recognition that the biological processes that spoil food are delayed if food is kept cold. Second, the recognition that heat flows from relatively hotter bodies to relatively cooler bodies, and that this heat flow can be slowed down by using thermal insulation. Paradigmatic examples of this
scientific knowledge are likely to occur to many people who are not familiar, say, with Newton's Laws of Cooling. While the solution is based on scientific knowledge, the problem itself is simply a fact of life about which there is widespread agreement.

A further step in this technology depends on additional scientific knowledge. Certain fluids, chlorofluorocarbons (CFCs) for example, will drop in temperature on expansion and will rise in temperature on compression. On its own, this scientific knowledge does not yield any technological knowledge. To yield technological knowledge, it must be linked with a problem related to human needs and wants. In this case, the problem might be how to keep food cool. One way is to insulate the food from the heat. Another way is to cause heat to flow from the food to something else. This is relatively simple if the heat flows to ice, which is colder than the food. It is more complicated if the heat is to flow to the external environment, which is hotter than the food. However, this can be achieved by storing the food in an enclosed space that is insulated from the external environment and by having a heat pump operating between the enclosed space and the external environment. The design of this heat pump is a curious hybrid of creativity and the application of scientific knowledge. It will also often conform to virtually universal engineering design practices.

Engineers are trained to design equipment to solve certain problems. This often involves designing a process by which the problems can be solved. The engineer is taught to design this process by breaking the problem down into sub-problems that can be individually addressed. In the case of the problem of cooling an enclosed space by moving heat from the cool enclosed space to a hotter external environment, the engineer might break the problem down into four sub-problems. First, in order for the enclosed space to be kept cold, heat must flow from the enclosed space to the CFCs. For heat to flow from the enclosed space to the CFCs, the CFCs must be colder than the enclosed space. Second, in order for the CFCs to be used again, this heat must be discharged to the external environment. For heat to flow from the CFCs to the external environment, the CFCs must be warmer than the external environment. Thus, the CFCs must be compressed when moving from the enclosed space to the external environment, and must expand when moving from the external environment to the enclosed space.
After breaking down the problem into separate sub-problems, a device can be designed by assembling pieces to solve each of these sub-problems. Specifically, the heat pump could include an internal heat transfer coil in the enclosed space and an external heat transfer coil in the external environment. To cool the CFCs down when they move from the external heat transfer coil to the internal heat transfer coil, the heat pump could include an expansion valve. This expansion valve should be insulated from the external environment to impede heat flow from the external environment to the cool CFCs. To warm the CFCs up when they move from the internal heat transfer coil to the external heat transfer coil, the heat pump could include a compressor. CFCs that start in the external heat transfer coil would flow to the expansion valve. In the expansion valve, the CFCs would expand, and, being thermally insulated, would also drop in temperature. Then the CFCs flow through the internal heat transfer coil. As the CFCs are at a lower temperature than the enclosed space, heat will flow from the enclosed space to the CFCs and the CFCs in the coil will warm up as the enclosed space cools. The CFCs then flow into the compressor where they are compressed and rise in temperature. From the compressor, the CFCs are released into the external heat transfer coil from which they radiate heat into the external environment.

The recognition that an enclosed space may be kept cool by causing heat to flow from a relatively cool region to a relatively hot region is not, on its own, technological knowledge. Some means of achieving this has to be determined. Similarly, the scientific knowledge that permits such a means to be developed is not technological knowledge without some way of linking it to the problem of keeping an enclosed space cool. Technological knowledge requires the marriage of the scientific knowledge with the problem, and this marriage takes the form of a machine, process, composition of matter or product that applies the scientific knowledge to solve the problem. To render the scientific knowledge applicable, the problems must often be broken down into sub-problems that can be solved by suitable components designed in accordance with the available scientific knowledge. These components often already exist, so that new technology is often only new in the way that it combines old elements.

In the above example, it does not seem unreasonable to say that the four components of a heat pump are the essential elements of a heat pump. The fact that we have terms such as “heat exchanger” and “compressor” may lead us to think that these terms
denote concepts that allow us to use these words. After all, without such concepts we would be unable to use these words. The concepts that these words denote inhabit a correlate picture of technology that we have in our minds. This correlate picture of technology allows us to determine all possible heat pumps without interacting with the external world.

This mentalist picture breaks down when we think of what is a compressor or a heat exchanger. A compressor is anything that compresses fluids. There are many different mechanisms for providing this function and more can always be devised. One having relevant skill cannot have all of these mechanisms in mind on hearing the term "compressor". Instead, the skilled person is able to identify things in the world that are alike in being compressors. Breaking down a machine into components makes it easier for a skilled person to see what is like the machine as such a person will have had experience in seeing how the individual components of the machine are like other previously known components. Typically, it will be more difficult to see how the entire machine is like anything previously known.

4.2: Putnam's externalist picture of scientific and technological terms
The foregoing description of a Kuhnian picture of science began with a mentalist picture in which scientific knowledge is constituted by generally applicable scientific laws. Another related mentalist picture is one according to which science teaches the fundamental elements of which matter is composed. According to a contemporary version of this picture, the periodic table provides a way of determining all of the elements of which matter can be composed. Each of the elements described in the periodic table seems to be definable by a common essence. Except for a few isotopes, all examples of a particular element have the same atomic weight and the same number of orbiting electrons. Accordingly, these elements seem to be readily accommodated within a mentalist picture of science. As a result, a mentalist picture of language may seem to fit the words used to denote these elements, as well as the molecules that result from combining these elements.

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37 Ignoring, for the moment, sub-atomic particles and isotopes.
In his article *The meaning of 'meaning'* Hilary Putnam argues that the correct use of terms such as water depends on users' interaction with their external environment and with other members of their linguistic community. As with Wittgenstein, the principal point brought out in the articles seems to be a negative one – viz. the inadequacy of the mentalist account of language. However, Putnam goes on to propose an alternative externalist account of language that can be usefully applied to the use of patent claims.

The terminology that Putnam uses is different from Wittgenstein's, but the view of language he attacks is similar to the Augustinian view. Putnam briefly describes a view of language that he describes as having been popular since the Middle Ages. According to this view, the concept of meaning is ambiguous. In one sense, the meaning of a word is its extension; in another sense, the meaning of a word is its intension. The extension of the word is the set of things that the word may be used to refer to. To Augustine, at least as interpreted by Wittgenstein, the meaning of a word is the object to which the word refers. Thus, the extension of a word is roughly analogous to what Augustine calls the meaning of a word, although the extension of a word covers any member of a set of objects rather than just an individual object.39

The intension of the word is the concept that establishes the correlation between it and each member of its extension. The concept provides necessary and sufficient conditions for determining the circumstances in which a word can be used. Presumably, we learn this concept of the word by abstracting what is common from all instances in which we witness the word being used. The common essence obtained by abstraction provides the concept for using the word.

39The objections that Wittgenstein makes to the Augustinian picture of language are also applicable to the extension/intension view of language. With respect to meaning as extension, this view of language may work well for nouns, and somewhat for verbs, but does not work at all for other kinds of words. As a description of language, "it is appropriate, but only for this narrowly circumscribed region, not for the whole of what you [Augustine and his followers] were claiming to describe" (*Philosophical Investigations*, supra, note 3 at 3). Wittgenstein does not get so far as meaning in the sense of intension, but contents himself with showing the unavoidable ambiguity in pointing to something, as well as in abstracting what is common from a number of different things. However, the point that there is unavoidable ambiguity involved in pointing at things does not help in determining what it is that patent claims point to. What is required here is some way of seeing a claim that is consistent with the fact that the claim does not unambiguously point to anything.
4.2.1: Twin Earth

Unlike Wittgenstein, who relies on observations about how words are used and the unavoidable ambiguity inherent in pointing to something, Putnam uses a Twin Earth thought experiment to show that the mentalist account of meaning rests on a problematic theory. One problem with this theory is that it leads to intensions being thought of as something in the mind. According to this view, it is not necessary for someone to interact with others or with the world in order to grasp the intension of a word. Instead, intensions are self-sufficient entities that can exist in isolation from the external world and from a community of people sharing the intension. To grasp an intension is to be in a particular psychological state. Once someone grasps the intension, then the intension determines the extension of the word.

If psychological state determines intension, and intension determines extension, then psychological state determines extension. Two people, call them Oscar₁ and Oscar₂, who have exactly the same beliefs about different liquids they both call 'water', will be in the same psychological state with respect to the term “water”. Accordingly, they will have the same intension for “water”. As intension determines extension, the extension of water for each should be the same.

Imagine that Oscar₁ and Oscar₂ live in completely different physical environments that nonetheless appear to be similar. At about 1750 Christian era, Oscar₁ is on Earth and Oscar₂ is on Twin Earth. Twin Earth resembles Earth in most respects, down to the fact that a language called “English” is used on each planet. Oscar₁ and Oscar₂ are identical. The liquid that Oscar₁ and other members of his linguistic community call “water” on Earth has the composition H₂O, although no one in his linguistic community is aware of this. The liquid that Oscar₂ and other members of his linguistic community call “water” on Twin Earth has a complicated chemical composition, the chemical formula of which is abbreviated as XYZ. Neither Oscar₂ nor other members of his linguistic community know the chemical composition of what they call “water”. Nonetheless, according to Putnam, Oscar₁ and Oscar₂ understand the word “water” differently because the extension of “water” on Earth is H₂O and the extension of “water” on Twin Earth is XYZ.

If Oscar₁ cannot distinguish XYZ from H₂O, then why doesn’t Oscar₁ mean both XYZ and H₂O when he says “water”? If Oscar₁ saw XYZ, then he would call it “water".
Putnam’s response is that when Oscar, says “water”, he is referring to what he or other members of his linguistic community have called “water” in the past. Thus, the extension of the word “water” is fixed by accepted usage within a linguistic community and by the part of the environment at which members of the linguistic community point when they say “water”. In the case of the Twin Earth example, Oscar, does not mean both XYZ and H₂O when he says “water” because of a feature of his environment; that there is no XYZ on Earth. Similarly, Oscar₂ means XYZ and not both XYZ and H₂O when he says “water” because there is no H₂O on Twin Earth.

Oscar, can tell someone what he means by “water” by an ostensive definition – pointing to a glass of water and saying, “this liquid is ‘water’” – or by a description that includes criteria for recognizing if a liquid is water. In the case of the ostensive definition, the “this” in “this is water” fixes the extension of “water” to the liquid referred to as “this” in the location indicated – in this case, to the liquid referred to as “this” on Earth. The meaning of “water” is not world relative, in the sense that “water” means something different on Twin Earth from what it means on Earth, as when Oscar, says “this liquid is ‘water’”, he is saying that “water” is whatever bears a certain sameness relation to the liquid referred to as “this” on Earth regardless of the location of such liquid.

If, instead of providing an ostensive definition, Oscar, describes what he means by “water”, then he will be describing the ways he has of recognizing water. However, Oscar, would not consider this description to be synonymous with the word “water” in the sense that it provides necessary and sufficient conditions for something to be “water”. Instead, he would agree that stuff determined to be “water” by his description is nonetheless not water when it does not bear the relation same liquid to normal examples of what he or other members of his linguistic community have called “water” in the past. Any definition or description of water is simply a way of pointing to a standard; in order for something to be water, it must bear a sameness relation to normal members of the class of local things that are determined by the description.

Whether the standard is pointed to by means of an ostensive definition or by means of a description or verbal definition, the definition is based on an empirical presupposition
that what is pointed to\textsuperscript{40} bears a certain sameness relation to the stuff that is called "water" by the speaker and other members of the speaker's linguistic community. Accordingly, the definition carries with it a defeasible necessary and sufficient condition: the necessary and sufficient condition for being water is to bear a certain sameness relation to the standard pointed to. This necessary and sufficient condition is defeasible as the condition holds true only if the above-mentioned empirical presupposition is satisfied.

As every verbal definition of a term is defeasible in the event that the definition points to stuff that does not bear the required sameness relation to other stuff that has previously been referred to using the same term, it follows that no description of the term is synonymous with the term. Instead, terms are used to refer to whatever has the same nature that things normally satisfying the description possess.

Returning to Twin Earth, Oscar\textsubscript{1} and Oscar\textsubscript{2} understand the word "water" differently because when each says "water", each is asserting a sameness relation between the liquid pointed it and most of the stuff that is called "water" by the speaker and other members of the speaker's linguistic community, and the stuff that Oscar\textsubscript{1} and Oscar\textsubscript{2} and their respective linguistic communities call "water" is different.

\textbf{4.2.2: The Linguistic Division of Labour}

Putnam relies on the Twin Earth thought experiment to argue that the real world makes a contribution to word extension. He then argues separately that society also contributes to word extension by considering the differences in people's understanding of the word "gold".

It is important to many people that something, a wedding ring say, actually be made of gold. Say that a ring is offered for sale. The ring is not made of gold but the vendor tells potential purchasers that it is made of gold. Someone buys the ring on the understanding that it is made of gold, and later learns that she has been deceived. If she complains to the vendor, then he cannot rely on the fact that she could not tell the

\textsuperscript{40} In the case of a description, what is pointed to are normal members of the class of things that are determined by the description. These normal members are paradigmatic instances of the word being defined.
ring from one that was made of gold to argue that she received what she asked for. What she asked for is not limited to what was in her mind when she used the word “gold”. It also depends on whether others would also recognize the ring as being made of gold.

People have acquired the word “gold” if their use of “gold” makes sense to other members of their linguistic community. Thus, the above purchaser has acquired the word “gold”. However, she is a layperson - despite having acquired the word “gold”, she is unable to herself distinguish gold from that which superficially resembles gold. Nonetheless, she is able to indirectly distinguish gold by cooperating with expert speakers in the same linguistic community who have ways of recognizing gold. Thus, the linguistic community considered as a collective body has ways of recognizing gold, but only a few people who have acquired the word “gold” are able to do so on their own. As a tool, language resembles a steamship, which requires the cooperation of many people to use, rather than resembling a screwdriver, which can be used by a single person alone.

4.3: Implications For The Use Of Claims
If the claims provide a map for variants of the invention and for avoiding the prior art and inoperable subject matter, then Kuhn and Putnam give some sense of the terrain covered by the map and of how the map must be used to navigate this terrain. Kuhn reminds us that all explanation must come to an end somewhere. An invention may be partially explained by breaking it down into elements, and these elements may in turn be partially explained by being broken down still further, but at some point we will have to explain the invention by relating the elements of the invention to things in the world. At that point, how we do this will depend on the way we have been taught to see things as like or unlike. This picture of science suggests that the map provided by the claims can only be used by those who have been trained in the relevant paradigms – the relevant ways of seeing things as like and unlike. The terrain covered by the maps does not consist of definitive laws and elements, but instead of landmarks that are generally, but not always, given like significance by those who have been trained in the relevant paradigms. These landmarks are not permanent - they may shift or disappear as the paradigm changes.
Putnam shows how our use of some words depends on our cooperation with those who are skilled in the use of those words. Accordingly, similar to Kuhn, Putnam shows that the use of claims requires the advice of experts who are skilled in using the terms of the claims. Laypersons are able to use claims because they are able to cooperate with people who are skilled in the language of the claims. The terms used in the claim, however, are not synonymous with any definition or description of their use. Experts may use definitions in determining if the terms of the claim apply to the features of an alleged infringement. However, the expert would agree that the real question is whether the features of the alleged infringement are the same as the features to which the terms of the claims are used to refer. If the features of the alleged infringement are the same as typical features designated by the terms of the claims, then there is infringement, regardless of whether or not the features of the alleged infringement are determined by the definitions of the terms of the claims. Contrariwise, if the features of the alleged infringement are not the same as typical features designated by the terms of the claims, then there is no infringement, regardless of whether or not the features of the alleged infringement are determined by the definitions of the terms of the claims. There will always have been errors in the ways in which the terms have been used in the past. Sometimes, dissimilar features will have been grouped together by being named by a common term. At other times, similar features will have been wrongly distinguished by being given different names. Thus, one who uses the map should be on guard for these mistakes and should always focus on the features themselves to determine whether they are alike, rather than relying on some definition of the terms of the claims.

There are many differences between Kuhn's and Putnam's pictures of science. For all of that, however, they are alike in many of their implications for how patent claims should be used. In order for their terms to be understood, patent claims should be read from the perspective of those skilled in the art of the invention. Determining if the patent claims would guide a skilled person to an alleged variant of the claimed invention will necessarily involve looking at the actual features referred to by elements in the claims and investigating their character to determine if they are like or unlike the features of the alleged variant. Definitions or rules for determining the scope of terms may sometimes be used; however, they are used simply to determine whether features are alike, and must be disregarded when they yield incorrect results.
In the next few chapters, I consider patent cases that have been decided by the United States Supreme Court over the last two hundred years. These cases show how the Supreme Court has often seemed to adhere to a mentalist view of language, but has occasionally recognized problems with this view of language, and has developed doctrines, such as the doctrine of equivalents, for identifying situations in which these problems are likely to arise, and for describing ways of mitigating these problems.
CHAPTER FIVE: CLAIM VALIDITY AND THE CONCEPT OF AN INVENTION

The preceding chapters have provided an introduction to patent claims and to some of the philosophical issues surrounding the use, meaning and context of claims. For the purposes of this introduction, the technology to which the claims related was confined to ways of stopping wheels from slipping. Patents, however, deal with a wide range of different technologies, and the adequacy of either a mentalist or an externalist perspective on language relative to patent claims can only be assessed by looking at how claims are used in a variety of technological contexts.

To provide this variety of technological contexts, a number of United States Supreme Court cases are examined in the next few chapters. The language game that Fred and Betty play is made possible by agreement that exists regarding a form of life in which wheels are used. This form of life differs from forms of life in which other technologies are used. These differences may, in turn, alter the nature of agreement from case to case. Thus, to understand the patent claim language game in each case, the form of life or technological background of that case must be considered in detail.

It is important to focus on the particular details of each of the cases considered, and not to leap to some general explanation of claim construction that is universally applicable to all cases, or even to some category of case, without considering the details that are not accommodated within or illuminated by this general explanation. If the technological details of each case are neglected in favour of the general legal propositions that also populate the cases, then it may seem that some general explanation is available when in fact the same words are being used in different ways in different cases. A general explanation that neglects the particular details of cases runs the risk of giving the impression that much more is understood, than is, in fact, understood.

The statutory history of the claim requirement is briefly described in the first section of this chapter. The cases examined in the next section deal with the origin of the requirement that patents include claims, and with the question of whether claims are necessary or helpful in distinguishing an invention. As it is only the invention as claimed that can be protected, these issues are connected to the question of what is an invention.
5.1: Statutory History

The first United States Patent Act was enacted in 1790,\textsuperscript{41} but was soon repealed by the Patent Act of 1793.\textsuperscript{42} Neither of the Acts expressly requires a patent specification to include claims. However, both of the Acts require a patent specification to distinguish the thing invented from what was previously known. Specifically, the 1790 Act requires a patent specification to include

"a description, accompanied with drafts or models and explanations and models (if the nature of the invention or discovery will admit of a model) of the thing or things, by him or them invented or discovered, and described as aforesaid, in the said patents; which specification shall be so particular, and said models so exact, as not only to distinguish the invention or discovery from other things before known and used, but also to enable a workman or other person skilled in the art or manufacture, whereof it is a branch, or wherewith it may be nearest connected, to make, construct or use the same, to the end that the public may have the full benefit thereof, after the expiration of the patent term....[emphasis added]\textsuperscript{43}

Unlike all subsequent Patent Acts, the 1790 Act contemplates that the invention may be distinguished from the prior art by an exact model as well as by a detailed description.

The Act of 1793 stipulates that for a patent to be granted, an inventor

"shall deliver a written description of his invention, and of the manner of using or process of compounding the same, in such full, clear and exact terms, as to distinguish the same from all other things before known, and to enable any person skilled in the art or science, of which it is a branch, or with which it is most nearly connected, to make, compound, and use the same. And in the case of any machine, he shall fully explain the principle, and the several modes in which he has contemplated the application of the principle or character, by which it may be distinguished from other inventions.... And such inventor shall, moreover, deliver a model of his machine, provided, the secretary shall deem such model to be necessary. [emphasis added]\textsuperscript{44}

Unlike the 1790 Act, the 1793 Act does not require models to be supplied whenever this is possible, but instead only requires models to be supplied where the secretary of the

\textsuperscript{41} Act of April 10, 1790, ch. 7, 1 Stat 109.
\textsuperscript{42} Act of Feb. 21, 1793, ch. 11, 1 Stat 318. Section 21 of this Act repealed the Act of 1790
\textsuperscript{43} Patent Act 1790, supra, note 41 at section 2.
\textsuperscript{44} Patent Act of 1793, supra, note 42 at section 3.
Patent Office considers such a model to be necessary. Further, the 1793 Act does not refer to the model as distinguishing the invention from what was previously known. Instead, this task is allocated wholly to the description.

The Patent Act of 1836 provides more detail than the earlier Acts on what patent applicants must do to distinguish their inventions from what was previously known. Specifically, the 1836 Act requires an applicant

"to deliver a written description of his invention or discovery, and of the manner and process of making, constructing, using, and compounding the same, in such full, clear and exact terms, avoiding unnecessary prolixity, as to enable any person skilled in the art or science to which it appertains, or with which it is most nearly connected, to make, construct, compound, and use the same; and in case of any machine, he shall fully explain the principle and the several modes in which he has contemplated the application of that principle or character by which it may be distinguished from other inventions; and shall particularly specify and point out the part, improvement, or combination which he claims as his own invention or discovery."46

The Patent Act of 1836 was repealed and replaced by the Patent Act of 1870. However, the new provision requiring the inclusion of claims, section 26 of the 1870 Act, remained substantially unchanged from section 6 of the 1836 Act.

The corresponding provision currently in force was enacted as section 112 of the Patent Act of 1952, and was amended again in 1965.48

"The specification shall contain a written 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, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention. The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention. A claim may be written in independent or, if the nature of the case admits, in dependent or multiple dependent form.

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45 Act of July 4, 1836, ch. 357, 20 Stat, 117
46 Ibid at section 6.
Subject to the following paragraph, a claim in dependent form shall contain a further limitation of the subject matter claimed. A claim in dependent form shall be construed to incorporate by reference all of the limitations of the claim to which it refers. A claim in multiple dependent form shall contain a reference in the alternative only, to more than one claim previously set forth and then specify a further limitation of the subject matter claimed. A multiple dependent claim shall not serve as a basis for any other multiple dependent claim. A multiple dependent claim shall be construed to incorporate by reference all of the limitations of the particular claim in relation to which it is being considered.

An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, materials, or acts described in the specification and equivalents thereof.49

Consistent with Kuhn's and Putnam's externalist pictures of science and technology, United States patent legislation has repeatedly recognized that the claims must be read from the perspective of a person skilled in the art of the invention. Accordingly, in patent litigation both sides typically retain expert witnesses to try to educate the court regarding the invention and the terminology used in the claims, and to advise on how the terms used in the claims would be understood by those who are skilled in the relevant art.

5.2: Are Definitions (Claims) Required To Distinguish An Invention?

5.2.1: Evans v. Eaton50

Evans v. Eaton, which was decided under the 1793 Act, is often cited as introducing the requirement that patents include claims. The Evans patent related to a hopper – the Hopperboy – used to spread "a granulated substance over a floor; to stir and expose it to air, to dry and cool it, and to gather it to the bolt."51 In the case, Evans argued that Eaton had infringed this patent.

Eaton admitted his use of the patented Hopperboy. His defense largely depended on the argument that the Evans patent was unenforceable for failing to distinguish the

49 Ibid at 112.
50 (1822), 20 U.S. (7 Heat) 356, 5 L. Ed. 472
51 Ibid at 359.
invention from the prior art – specifically from a Stouffer Hopperboy, which was allegedly in use before the Evan's patent.

In deciding the case, the court was provided with models of both the Hopperboy and the Stouffer Hopperboy. In both the Evans Hopperboy and the Stouffer Hopperboy waterpower is used to turn a shaft. The shaft of the Stouffer Hopperboy has a roughly square cross-section and passes through a square aperture in an arm. The shaft fits snugly within the square aperture of the arm such that rotation of the shaft rotates the arm. Flights are fixed to the arm, projecting downwardly from the arm. Waterpower turns the shaft, which in turn rotates the shaft and the attached flights. The attached flights then move through the meal, to stir and cool it, and to move it towards the bolting (sifting) chest.

As meal is added to the floor and is moved toward the bolting chest, the level of meal may vary. However, the arm of the Stouffer Hopperboy is fixed to the shaft at a given height, making it impossible for the Stouffer arms to rise or fall on their own. As a result, when new meal is placed on the floor, the operation of the Stouffer Hopperboy must be halted and the arms raised to a suitable height. Thus, the Stouffer Hopperboy cannot be operated continuously and without supervision.

Unlike the Stouffer Hopperboy, the shaft of the Evans Hopperboy is round. The shaft of the Evans Hopperboy passes though matching circular apertures in the attached arms. However, as the shaft fits only loosely within the matching apertures, and as both the former and the latter are round, the shaft is free to rotate without rotating the arms. Instead of the shaft rotating the arms by direct action, the shaft includes a leader, which is an upper arm that is fixed to the shaft to rotate when the shaft rotates. Cords extend from the leader to the arms to rotate the arms when the shaft and leader rotate. Each of these cords also passes over a pulley and has a counterweight attached to the end of the cord opposite to the attached arm. The counterweight is selected to be almost as heavy as the arm to which it is attached via the cord, so that the arms are free to rise and fall on their own. In operation, the shaft turns the leader thereby also turning the arms. The cords and counterweights attached to the arms enable the arms to play upward and downward according to the amount of meal on the floor.
After describing his invention in the patent specification, Evans claims his invention as follows:

"I claim as my invention, the peculiar properties which this machine possesses; viz. the spreading, turning, and gathering the meal at one operation; and the rising and lowering its arms by the motion, to accommodate itself to any quantity of grain it has to operate on."\(^{52}\)

One of the distinctions the Supreme Court considered to be relevant to this case was whether the Evans patent was for a machine or for an improvement. Both machines and improvements were patentable under the 1793 Act. However, in the event that the Evans Hopperboy was only an improvement, the specification had to distinguish the Evans Hopperboy from previously known Hopperboys.

At trial, in the Circuit Court of Pennsylvania, Washington J. instructed the jury on the test to apply in determining if Evans was the original inventor of his Hopperboy:

"if the two machines be substantially the same, and operate in the same manner, to produce the same result, though they may differ in form, proportions, and utility, they are the same in principle; and the one last discovered has no other merit that that of being an improved imitation of the one before discovered and in use, for which no valid patent can be granted, because he cannot be considered as the original inventor of the machine.... The question for the jury then is, are the two Hopperboys substantially the same in principle? Not whether the plaintiff’s Hopperboy is preferable to the other. Because if that superiority amounts to an improvement, he is entitled to a patent only for an improvement, and not for the whole machine."\(^{53}\)

Applying this test, the jury determined that Evans was not the inventor of the Hopperboy as the Evans Hopperboy was substantially the same as the Stouffer Hopperboy.

Even if Evans was not the inventor of the Hopperboy as a machine, he certainly seemed to be the inventor of improvements in the machine as his Hopperboy afforded clear advantages over the Stouffer Hopperboy. However, in this respect Washington J. found that the patent was void because the nature and the extent of the improvements were not stated in the specification. In his instructions to the jury, Washington concluded that

\(^{52}\) *Ibid* at 411.
\(^{53}\) *Ibid* at 362 to 363.
"the specification communicates no information whatever upon any of these parts. This being so...the plaintiff cannot recover for an improvement."54

This decision was subsequently affirmed by a four to three majority of the Supreme Court of the United States. Story J., for the majority, held that the Circuit Court jury had been properly instructed as to the correct test to apply to determine if Evans had invented a machine. Given the jury's decision that the Evans Hopperboy was substantially the same as the Stouffer Hopperboy, the Evans patent could only have covered an improvement. However, as to covering an improvement, the specification of the Evan's patent did not comply with the statutory requirement that it describe the invention "in such full, clear and exact terms, as to distinguish the same from all other things before known..."55. To Mr. Justice Story

"How can that be a sufficient specification of an improvement in a machine, which does not distinguish what the improvement is, nor state in what it consists, nor how far the invention extends? Which describes the machine fully and accurately, as a whole, mixing up the new and the old, but does not in the slightest degree explain what is the nature or limit of the improvement which the party claims as his own. It seems to us perfectly clear that such a specification is indispensable. We do not say that the party is bound to describe the old machine; but we are of the opinion that he ought to describe what his own improvement is, and to limit his patent to such improvement."56

In his dissent, Livingston J. pointed out that if a machine were made in accordance with the specification provided in the Evan's patent, then that machine could very easily be distinguished from anything previously known. Any skilled mechanic would on reading his description quickly see the differences between the Evans Hopperboy and the Stouffer Hopperboy. Further, it would be impossible for the specification to specify every respect in which the patented subject matter differed from what was previously known. To prevent innocent infringement it is enough that the public can distinguish the machine taught by the specification from the machines previously known.

While the minority found that Evans had distinguished his invention from what was previously known, they did not rely on the claim included in his patent to make this

54 Ibid at 366.
56 Evans, supra, note 50 at 434 to 435.
finding but instead pointed to the specification. The majority found that Evans had not distinguished his invention from what was previously known. Accordingly, both the majority and the minority agreed at least on the point that the claim that Evans included in his patent did not distinguish his invention from what was previously known.

Claims differ from the specification in that the claims are aimed not at the particular preferred embodiments of the invention, but at the entire range of possible embodiments of the invention. Arguably, the fact that the public can distinguish the machine taught by the specification from the machines previously known is not enough to prevent innocent infringement. While a skilled mechanic would, on reading the specification, see differences between the Evans Hopperboy and the Stouffer Hopperboy, he would not be able to determine the scope of the invention.

Say that after reading the Evans patent, the mechanic devised another pressure-operated Hopperboy that functioned differently to obtain the same result. Say, for example, that a fluid underlies the floor receiving the meal, and that the floor is resilient such that the pressure of the meal on the floor is transferred to this fluid. Say also that the arms of the pressure-operated Hopperboy are supported at a height above the floor by the fluid pressure, and that this height is calibrated such that the height of the arms is automatically changed to accommodate different amounts of meal within a certain range. For example, as meal is added, the weight on the resilient floor increases, thereby increasing the fluid pressure of the fluid underlying the floor. The arms are supported by this fluid pressure and are therefore raised by an amount proportional to the increase in fluid pressure and to the increase in the amount of meal on the floor. The shaft of this pressure-operated Hopperboy has a square cross-section and fits loosely within square apertures in the arms. As a result of the square cross-section rotating within square apertures, the arms are forced to rotate when the shaft rotates. However, as a result of the loose fit, the arms are also free to move up and down relative to the height of the shaft.

Would this pressure-operated Hopperboy infringe the Evans patent, assuming this patent is valid? Evan's invention seems to consist of two parts: first, the recognition of a problem with the prior art Hopperboy – viz. the fact that the arms do not automatically rise and fall to accommodate different amounts of meal - and, secondly, the design of a
mechanism to overcome this problem. One who reads this patent may then rely on the recognition of the problem without appropriating the mechanism. Does this constitute infringement? Certainly, if Evans had only recognized the problem, then there would have been no invention. Instead, there would be merely an unsolved problem. This suggests that it is the mechanism and not the recognition of the problem that is constitutive of the invention. Yet mechanisms that solve the problem may be obvious once the problem is recognized – that is, the recognition of the problem rather than the devising of the mechanism may satisfy the patentability requirement of unobviousness.

The claim that Evans included in his patent focuses on the problem that the arms of prior Hopperboys do not rise and fall to accommodate different levels of meal, by reciting the function of his machine that distinguishes it from all other machines: “the spreading, turning, and gathering the meal at one operation; and the rising and lowering its arms by the motion, to accommodate itself to any quantity of grain it has to operate on.”

Despite the Supreme Court’s finding that the patent does not distinguish the improvement, this function does distinguish the improvement as it points to a function that the prior Hopperboys could not perform. However, Evans’ patent covered a machine, and, according to the Supreme Court, a machine is defined by its structure, and not by its function. Thus, in this case the Supreme Court’s answer seems to be that an invention is a mechanism rather than the recognition of a problem, and the claims must be drafted to distinguish the structure of the mechanism from the prior art.

In this case, I differ from the Supreme Court on the nature of the invention. To me, the pressure-operated Hopperboy is a variant of the Evans Hopperboy. This conception of the invention can be drawn from the background of the invention and the invention itself. Evans has provided a solution to a problem with the prior art. There was no dispute in the case that this solution was patentable. However, to limit the patentable invention to a particular kind of mechanism when a number of different kinds of mechanism also fulfill the inventive function is to make patent protection for these solutions to technological problems into a hollow and useless thing. Patents that can easily be circumvented regardless of how the claims are drafted provide no protection at all.

\[57\] Ibid at 411.
Given the requirement that a machine be defined in terms of its structure, and not its function, there does not seem to be anyway that Evans can distinguish his invention from the prior art without providing room for others to take his invention (as I conceive it) without infringing the claims. How, without using functional terms, would Evans write a claim that extended to the above-described pressure-operated Hopperboy, given that this Hopperboy relies on a completely different structure that provides a similar function?

At the same time, it is easy to understand the reluctance of the Supreme Court to rely on Evan's claims, given that the Supreme Court appears to adhere to a mentalist picture of language, science and technology. According to this picture, just as a scientist's mind holds a correlate picture of the external world, an inventor's mind holds a correlate picture of her invention. Once someone grasps this correlate picture of the invention, he fully understands the operation of all possible variants of the invention in the external world. This correlate picture of the invention can be expressed in writing, but is not expressed simply by describing a preferred variant of the invention as such a description does not give a sense of what distinguishes the invention from the prior art, or of the range of possible variants of the invention. Instead, it is the claims that must be written to provide a correlate picture of the invention that extends to all variants of the invention, and distinguishes the invention from the prior art. By reading the claims, one sees into the inventor's mind to grasp the correlate picture that is held there. Once the correlate picture of the invention is grasped, the reader can identify any variant of the invention.

If the foregoing is the picture of language and technology that is held by the Supreme Court, then their objections to functional language in the claims are easily understood. A reader of claims expressed in functional terms does not gain thereby a window into the inventor's mind that reveals all possible variants of the invention. Instead, merely a way of recognizing variants of the invention is provided. If the reader is going to grasp any correlate picture of variants of the invention, then the reader must also contribute something to this correlate picture – viz. various structures suitable for providing the claimed function. Despite the opacity of Evan's claim in revealing variants of the invention, such a claim purports to extend to any mechanism that provides the claimed function, regardless of whether or not that new mechanism is similar to the disclosed mechanism in the sense that a skilled reader of the Evans patent would have thought of the new mechanism as a solution to the problem to which the disclosed mechanism is
directed. In other words, under a mentalist construction the claims will either be too narrow, as in situations where essential structural elements must be identified, or too broad, as in situations where the essential functional elements are identified. According to a mentalist picture of language, the claims cannot serve their purpose of distinguishing the invention.

It may be possible to provide appropriate protection by letting go of the illusion that the extent of this protection can either be completely captured in language, or can be determined solely from the correlate picture of the invention that is in the inventor's mind. Specifically, Evans' claim can be thought of as a map of the technological art to which the invention relates. The functional features listed in the claim can then be seen as directions around a feature of the landscape of the art that has existed for a while, but has not been recognized. This feature is the fact that the arms of prior hopperboys cannot rise or fall on their own to accommodate different levels of meal. By building a hopperboy having the claimed functions, this feature can be avoided. Nonetheless, while the map points to many ways around this feature of the prior art, it may not point to every way around this feature.

In Evans, the Supreme Court held that a mere description of the inventive improvement combined with that which was already known does not "distinguish what the improvement is, nor state in what it consists, nor how far the invention extends." When the claims are construed according an externalist picture of language, they can help to distinguish what the improvement is, and how far it extends. The claims can also state in what the invention consists, as long as this task is understood as involving looking at the features of the art of the invention that the claim points to when deciding questions of validity or infringement. However, none of these tasks can be performed by the claims if they are merely read as expressing what is in the inventor's mind, and what is in the inventor's mind is taken to be definitive of the invention. The inventor may well have a correlate picture of the invention in his mind that includes many hopperboy mechanisms that provide the claimed function, but this correlate picture will not include all possible variants of his invention as there may be a virtually inexhaustible number of these, and new mechanisms may always be devised.
The dissent in *Evans* seems to deny that anything more than a description of the preferred embodiment of the invention is required to supply a rule for determining whether something that differs from the disclosed embodiment of the invention infringes the patent. In a subsequent case, *Machine Co. v. Murphy*[^59], the Supreme Court seems to escape, albeit briefly, the picture of language that shaped its decision in *Evans* and in most of the subsequent case law. This case regarded a patent for improvements in machinery for making paper bags.

5.2.2: *Machine Co. v. Murphy*

Machines for making paper bags were well known at the date of invention. The patented invention relates to the cutting involved in making paper bags. Although the patent contains seven claims, the plaintiff alleged only that the defendant had infringed claim 1, which reads as follows: "Making the cutter which cuts the paper from the roll in such form that in cutting off the paper it cuts it in the required form to fold into a bag without further cutting out."[^60]

The machine includes a frame for supporting all of its parts, and a table for supporting the paper as it is unwound from the roll and moved forward under the cutter. The paper wound on the roll has a width suitable for it to be folded lengthwise and thereafter formed into a bag. The machine also includes feed-rollers for moving the paper under the cutter. The cutter operates vertically. Its downward motion is the result of its own weight, which provides sufficient force for the cutter to cut the paper. The cutter is moved upward by two cams that are mounted on a constantly rotating horizontal shaft. The inventive feature of the cutter seems to lie in it having five planes, which imparts a shape to the paper that enables it to be folded into a bag without further cutting.

Unlike the cutter of the patented machine, the cutter of the defendant’s machine is a knife having a serrated edge. This knife has substantially the same configuration of cutting edge as the cutter of the patented machine, but does not rise or fall to cut the paper. Instead, the paper is pushed out over the serrated edge, and a striker forces the

[^58]: *Ibid* at 434.
[^59]: 97 U.S. 120 (1877)
[^60]: *Ibid* at 122.
paper down onto the serrated edge. The striker is a blunt-edged straight piece of metal, and is moved by a shaft that first raises it and then throws it down onto the paper.

In concluding that the defendant had infringed the plaintiff's patent, the Supreme Court did not explicitly consider the claim at all. Instead, the Court held that

"argument to show that the form of the knife and the cutter are substantially the same is quite unnecessary, as that is proved through a demonstration by a comparison of the two edges. Nor can it make any difference that the cutter is made to cut the paper by its own gravity, while the knife is made to cut by the fall of a device, which performs no other function than to fall upon the paper at the proper moment, and cause the stationary knife to cut for the same purpose....

Except where the form is of the essence of the invention, it has but little weight in the decision of such an issue, the correct rule being that, in determining the question of infringement, the court or jury, as the case may be, are not to judge about similarities or differences by the names of things, but are to look at the machine or their several devices or elements in the light of what they do, or what office or function they perform, and how they perform it, and to find that one thing is substantially the same as another, if it performs substantially the same function in substantially the same way to obtain the same result, always bearing in mind that devices in a patented machine are different in the sense of the patent law when they perform different functions, or in a different way, or produce a substantially different result [emphasis added]."\(^{61}\)

Far from the Court requiring a written definition of the invention in this case, it holds that arguments and names of things are of little use; what is really required is for the Court to look at the actual technology. Certainly, it is difficult to see how a Court adhering to a mentalist picture of language would interpret the claim "Making the cutter which cuts the paper from the roll in such form that in cutting off the paper it cuts it in the required form to fold into a bag without further cutting out."\(^{62}\) It is impossible to say that the essence expressed by the words of this claim captures the structural essence of all machines embodying the invention. Probably, such a Court would find the patent to be invalid both for failing to distinguish the invention from the prior art and for failing to define the extent of the invention.

Recall the claim of the Evans patent:

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\(^{61}\) *Ibid* at 124 to 125.
"I claim as my invention, the peculiar properties which this machine possesses; viz. the spreading, turning, and gathering the meal at one operation; and the rising and lowering its arms by the motion, to accommodate itself to any quantity of grain it has to operate on." 63

In the Evans case, this claim was not considered to be even a candidate for distinguishing the invention from what was previously known. Even the minority, who would have upheld the patent, did not find that the claim distinguished the invention from what was previously known. Instead, the minority found that this requirement was fulfilled by the specification, while the majority found that this requirement was not fulfilled at all.

Compare the claim of the Machine Co. patent with the claim of the Evans patent. Both are written almost entirely in functional language. If the Supreme Court had adopted the 
Evans approach in Machine Co., then the claim would have been found to be invalid. Contrariwise, if the court in Evans had used the test laid down in Machine Co. and had looked at the machines in light of what they do, then it might well have found the Evans patent to be valid and infringed.

The Machine Co. and Evans decisions seem to be utterly opposed to each other, although both show traces of a mentalist picture of language. The Machine Co. decision stipulates that in determining the question of infringement, the courts are not to "judge about similarities or differences by the names of things, but are to look at the machine or their several devices or elements in the light of what they do, or what office or function they perform, and how they perform it...". 64 When coupled with the observation that "argument to show that the form of the knife and the cutter are substantially the same is quite unnecessary, as that is proved through a demonstration of the two edges" 65, the Court seems to reveal a view of the names of things as somehow being independent of the things themselves, such that considering the similarities or differences in the names of things does not entail looking at the elements named in light of what they do and how they do it. The Court departs from a mentalist picture of language in concluding that because language is like this it cannot possibly contribute anything to questions of

62 Ibid at 122.
63 Evans, supra, note 50 at 411
64 Machine Co., supra, note 59 at 124.
infringement and validity. It is as if the Court is saying that the claims do provide a picture of the invention, only this picture does not necessarily have anything to do with the operation of the invention in the external world. In contrast, the Evans decision suggests that language must be used to distinguish the invention from the prior art and to define its limits. This is certainly consistent with a mentalist picture of language, and in its reliance on language differs from the Machine Co. decision.

The Machine Co. decision reveals a very unusual perspective on language in which the names of things are disconnected from the things themselves such that argument is unnecessary in deciding if two things are alike. According to this view of language, there seems to be little or no point in including claims in a patent. If the invention is disclosed in the patent, and the courts are to judge issues of infringement and validity by looking at the actual machines and processes and not by ruling on the meaning of the terms in the claim, then there does not seem to be much of a task left for claims. Wittgenstein and Putnam provide reasons why this view of language is incorrect. For us to have language, we must agree in judgment about the things for which we have words. Thus, by using words to define the invention in the claims, the inventor is invoking our collective experience regarding technological components, which collective experience has given rise to agreement on what things are alike in being named by those terms. Thus, while we should judge rather by the nature of things than by the conventional use of the words that name them, the conventional use of these names helps us to judge according to the nature of things by invoking our collective experience regarding these things.

The Machine Co. decision also speaks of the several devices or elements of a machine. In practice, there will often be many different ways of breaking a patented machine down into elements. It may be that the way in which the patented machine is broken down into elements will determine whether there is infringement, or the scope of protection to which the patentee is entitled. Accordingly, claims will also have a role to play where courts decide issues of infringement and validity by looking at the actual machines and processes and not by ruling on the meaning of the terms in the claim. In fact, the way in which claims break an invention down into elements is critical to the application of the doctrine of equivalents, which is considered in the next chapter.

65 Ibid.
CHAPTER SIX: THE DOCTRINE OF EQUIVALENTS

Typically, a machine comprises different elements or component parts. Each of these component parts has a different function. The machine is configured so that these different functions cooperate to provide the function of the machine. Thus, in the case of a heat pump, the internal heat exchanger, the compressor, the external heat exchanger and the expansion valve cooperate to transfer heat from a cooler space to a hotter space. The function of each of these component parts is required to effect heat transfer. Thus, each of these component parts is an essential element of a heat pump.

According to a mentalist view of language and technology, (1) machines can be broken down into essential elements, (2) these essential elements can then be named, (3) these names designate concepts of the essential elements, and (4) once grasped, these concepts determine all examples of the essential elements. Thus, drafting a claim involves (1) breaking down an invention into essential elements, (2) naming those elements, and (3) writing a claim that includes these names and describes their interrelationship. On reading the names in the claim, a reader will grasp the concepts of the essential elements as well as their interrelationship. This allows the reader to determine all variants of the invention. Thus, a competitor will be unable to take the advantages of the invention without infringing a carefully drafted claim that refers to only the essential elements of the invention. Embodiments of the invention can be distinguished from other machines simply on the basis of what falls under the extension of the terms of the claim.

Say that the courts start with a mentalist view of technology and language. However, as cases arise the courts find that this view of language leads to results that seem unjust. For example, a court may find that it was impossible to identify essential features of the invention, such that requiring a patentee to identify essential features of the invention is tantamount to denying patent protection for the invention. In such situations, the courts may try and come up with ways of mitigating the application of their mentalist perspective, while still partially retaining this perspective. The doctrine of equivalents arguably represents an attempt to mitigate the harshness resulting from the application of a mentalist view of technology and language. As the doctrine of equivalents is designed to be applicable precisely where the mentalist view of technology and language fails, it may provide insight into the actual externalist character of technology.
and language. Examining the cases in which the doctrine of equivalents has been applied may also provide experience of the ways in which a mentalist view of language can go wrong.

In this chapter, early cases in which the doctrine of equivalents was applied are considered. *Winans v. Denmead*,66 is the most famous of these early cases. This case is still cited more often than not whenever the doctrine of equivalents is invoked.

6.1: *Winans v. Denmead*

Prior to Winans' invention, railroad cars for carrying coal had a rectangular floor plan. The coal exerted an outward pressure on the sides of the railroad car, which tended to buckle and deform the car, requiring the car to be made still stronger to resist buckling and deformation. As more metal was required to build stronger cars, and such cars were inevitably heavier, this increased the expense of transporting coal by rail.

In his patent, Winans describes and claims a railroad car made of sheet metal having a cylindrical upper portion and a lower portion in the shape of a frustrum of a cone. The lower portion is formed as a frustrum of a cone instead of a cone as it has a movable bottom for opening the base of the car to discharge the load of coal. The shape of the lower portion of the railroad car permits this portion to extend below the truck and between the wheels, thereby increasing the space available to store coal, and reducing the center of gravity of the load. Further, due to the circular form of the car, the pressure exerted by the coal is resisted everywhere by the tensile strength of the sheet metal. Thus, the load balances itself so that the tensile strength of the sheet metal carries this load, instead of, as with the prior railroad cars, the sheet metal having to resist buckling due to the pressure exerted by the coal. It was uncontested that as a result of this invention, the ratio of weight of the load of coal to the weight of the railroad car could be increased from about one to four.

Winans claimed his invention as follows:

"What I claim as my invention is...making the body of a car for the transportation of coal, &c., in the form of a frustrum of a cone, substantially as herein described, whereby the force exerted by the weight of the load presses equally in all directions

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and does not tend to change the form thereof, so that every part
resists its equal proportion, and by which also the lower part is
so reduced as to pass down within the truck frame, and between
the axles, to lower the center of gravity of the load, without
diminishing the capacity of the car as described.”\textsuperscript{67}

The defendant, having seen the plaintiff’s cars, built not cylindrical but octagonal railroad
cars. Using these octagonal railroad cars, the defendant was able to enjoy efficiency
gains comparable to the plaintiff’s. The plaintiff sued the defendant for patent
infringement, arguing that the patent was infringed as the defendant had obtained the
same useful results as the plaintiff through the same principles of construction. In its
defense, the defendant argued that its cars, being octagonal, did not infringe the patent.

In a patent trial,

“two questions arise. The first is, what is the thing patented; the
second, has that thing been constructed used or sold by the
defendants.
The first is a question of law, to be determined by the court,
construing the letters-patent, and the description of the invention,
and the specification of claim annexed to them. The second is a
question of fact, to be submitted to a jury.”\textsuperscript{68}

At trial, after construing the patent, the court instructed the jury

“that while the patent is good for what is described therein; a
conical body in whole or in part, supported in any of the modes
indicated for a mode of sustaining a conical body on a carriage
or a truck, and drawing the same, and for those principles which
are due alone to conical vehicles and not to rectilinear bodies;
and it being admitted that the defendant’s car was entirely
rectilinear, that there was no infringement of the plaintiff’s
patent.”\textsuperscript{69}

By these instructions, the court left nothing for the jury to decide, having decided already
that the claims of the patent could not extend to the defendant’s railroad car. The jury
accordingly rendered a verdict for the defendant.

On appeal to the Supreme Court, the plaintiff argued that the court had erred both in its
construction of the claim and in its instructions to the jury. Specifically, the plaintiff

\textsuperscript{67} Ibid at 331.
\textsuperscript{68} Ibid at 337.
\textsuperscript{69} Ibid at 336.
argued that the claim should not be construed to cover only railroad cars having a strictly conical form, and that, even supposing the court's construction of the claim was correct, the court erred in excluding from the jury's consideration the question of whether the defendant's cars were substantially the same as the cars of the plaintiff. In response, the defendant argued that (1) the trial court had correctly construed the claim to cover only curvilinear forms and to exclude the rectilinear forms from coverage, and (2) given this construction of the claims, which was a pure matter of law, the court was right to exclude from the jury's consideration the question of whether the defendant's cars were substantially the same as the cars of the plaintiff.

In reversing the decision of the trial court, the Supreme Court noted that patents are granted not for changes in the form of machines, but rather for changes in the principles underlying the operation of machines:

"To change the form of an existing machine and by means of such change to introduce and employ other mechanical principles or natural powers, or, as it is termed, a new mode of operation, and thus attain a new and useful result, is the subject of a patent."\(^{70}\)

Accordingly,

"it is generally true, when a patentee describes a machine, and then claims it as described, that he is understood to intend to claim, and does by law actually cover, not only the precise forms he had described, but all other forms which embody his invention; it being a familiar rule that, to copy the principle or mode of operation described, is an infringement, although such copy should be totally unlike the original in form or proportions."\(^{71}\)

There will be cases in which the scope of a patent is limited

"to the particular form described and claimed....

"The reason why such a patent covers only one geometrical form, is not that the patentee has described and claimed that form only; it is because that form only is capable of embodying his invention; and, consequently, if the form is not copied, the invention is not used."\(^{72}\)

Thus, where principles can act only through a single form, only this form need be protected. However, where, as is usually the case, the same principles can operate

\(^{70}\) Ibid at 340.
\(^{71}\) Ibid at 341.
\(^{72}\) Ibid at 342.
through different forms, both the court and the jury must look beneath the form for the substance of the invention, and where this substance is taken, there is infringement even if the form that is described and claimed in the patent is not taken:

"the patentee, having described his invention, and shown its principles, and claimed it in that form which most perfectly embodies it, is, in contemplation of law, deemed to claim every form in which his invention may be copied, unless he manifest an intention to disclaim some of those forms."73

The relevant question was whether the defendant's octagonal cars were sufficiently close to the patented circular cars to infringe the patent. The Supreme Court determined that there was strong evidence indicating that the defendant's octagonal cars were sufficiently close to the patented circular cars to infringe the patent. Accordingly, the trial court had erred in excluding this question from consideration by the jury.

In the majority's view, the purpose of the claim seems to be to point to an ideal form of the invention. From this form, the court will then be able to discern the principles underlying the operation of the invention and will be able to determine if these principles underlie the operation of the alleged infringement. In Winans, this task was facilitated by the claim reciting the principles of the invention after reciting its conical form. People may differ as to those principles to which either words or a particular form points. In particular, four of the nine justices of the Supreme Court differed from the majority on the character of the principles to which the Winans claim pointed.

Justice Campbell, for the minority, began his judgment by pointing out that the advantages of the conical or circular form had long been known - viz. this form is best able to resist pressure from within and requires the minimum material to enclose a given area or volume. Accordingly, despite the great advantages enjoyed by the patented railroad car, he was inclined to object to this patent having been granted at all, as the use of the conical form in the patented railroad car seemed to be strictly analogous to previously known uses of the conical form. The patentability of the Winans railroad car was not at issue in the appeal. However, this perspective on the scope and merit of the invention seems to also have influenced the minority's determination of what principles characterized the invention.

73 Ibid at 384.
The theoretical advantages of the conical or circular forms are well known, and were, of course, well known to the plaintiff. Relying on this theoretical knowledge, the inventor, in the patent specification

"describes this form, as a matter of his invention, and the principle he develops applies to no other form. For this he claims his patent. We [the Courts] are authorized to conclude, that his precise and definite specification and claim were designed to ascertain exactly the limits of his invention."\(^74\)

From a theoretical perspective, the plaintiff's railroad car was superior to the defendant's. Yet experts for both parties testified that the results obtained by both kinds of railroad cars were much the same. This discrepancy points to factors that the plaintiff failed to take into account:

"The course, heavy, cumbersome operations of coal transportation do not admit of the manufacture of cars upon nice mathematical formulas, nor can the loads be adjusted with much reference to exactness....

The patentee, not exaggerating the theoretical superiority of the form of his car, overlooked those facts which reduced its practical value to the level of cars of a form widely variant from his own. The object of the suit is to repair that defect of observation. It is, that this court shall extend, by construction, the scope and operation of his patent, to embrace every form which in practice will yield a result substantially equal or approximate to his own."\(^75\)

The principle of a patented invention cannot be determined by evidence as to what actual principles operate in the invention and the alleged infringement. It is the version of the principles taught in the patent specification that is relevant. Here,

"the plaintiff confines his claim to the use of the conical form, and excludes from his specification any allusion to any other. He must have done so advisedly. He might have been unwilling to expose the validity of his patent, by the assertion of a right to any other. Can he abandon the ground of his patent, and ask now, for the exclusive use of all cars, which, by experiment, shall be found to yield the advantages which he anticipated for conical forms only?"\(^76\)

\(^74\) Ibid at 345.
\(^75\) Ibid at 345 to 346.
\(^76\) Ibid at 346.
If the claims are extended to cover octagonal forms, then how much further could they be extended? The resulting uncertainty and danger to competitors would deter further innovation and enterprise. It was for this reason that Congress required the patentee to particularly specify and point out what is claimed as the invention. In this case, the language of the patent claim particularly specifies and points out a range of subject matter that does not include the defendant's octagonal cars. Accordingly, there is no infringement.

In *Winans*, the majority's judgment referred to the principles of the invention that can be embodied in other forms. The majority does not seem to have considered the difference between the principles the inventor seems to have had in mind when drafting the claim, and the principles that are subsequently found to underlie the invention. The minority did have this distinction in mind, and found that due to the inventor's overly theoretical perspective, he failed to appreciate that these principles would also operate through some rectilinear forms. However, it seems to me to be highly unlikely that the inventor would have failed to appreciate that these principles would also operate through some rectilinear forms. Further, it seems to me that a skilled person, to whom the claim is addressed under the 1836 Act, would have known on reading the specification that the same principles would have applied to an octagonal railroad car, and would have assumed that the inventor intended to cover rectilinear forms that approach a conical form when using the term "conical" in the claim. This is not to say that Winans thought of the possibility of octagonal cars when drafting the claim. If he had, then he probably would have drafted the claim more broadly.

*Winans* is a paradigmatic case for the application of the doctrine of equivalents. It is still cited by courts. *Winans* is also a case in which the invention seems to be governed by scientific principles. In Kuhnian terms, a circular form for resisting internal pressure is a paradigm – it is accepted as a standard illustration of the application of scientific theory by everyone in a scientific community. By requiring the body of the rail car to have a circular form, the inventor invoked this paradigm.

Students in physics and engineering are taught a process to be followed religiously in solving problems in solid mechanics. First they isolate the part of interest and draw a free body diagram to represent that part. Then they identify all the forces acting on that
point and draw all of these forces on the free body diagram. The geometrical relations between the different forces must be preserved when they are being drawn on the free body diagram as the vector sum of these forces is the net force acting on the free body. If students follow this process, and recognize all of the forces that act on the part of interest, then they have a good chance of getting the "right" answer – the answer that would be obtained by skilled physicists and engineers.

In the case of the Winans invention, the underlying principles are in part geometrical, in part physical and in part material. Coal containers are typically made of metal. Metal, unlike concrete, resists tension better than it resists other forces – when metal is subjected to non-tensile forces, it tends to buckle unless greatly reinforced.\(^\text{77}\) Metal buckles when the bending forces about a point are too great for the metal to resist. Bending forces are a function not only of the force, but also of the distance separating the force from the point of interest. That is, the bending force or moment at a point will equal the force multiplied by the perpendicular distance separating the force from the point of interest. Accordingly, metal containers will be able to take far greater loads if the loads are distributed so as to minimize non-tensile forces, as well as to minimize the distance over which they act.

Recall how Winans claimed his invention as a rail car "in the form of a frustrum of a cone...whereby the force exerted by the weight of the load presses equally in all directions and does not tend to change the form thereof, so that every part resists its equal proportion..."\(^\text{78}\). Consider a wall of a circular container. As noted in the claim, the outward force of the coal presses equally in all directions. Consider any small portion of the circular container. This small portion has three forces acting on it: the tensile force exerted on it on each side by the adjacent portions of wall, and the force of the coal against that portion of the wall. However, the force of the coal is not perpendicular to the tensile force as the circular wall is curved. Accordingly, relative to the midpoint of the small portion of the circular container, the tensile force exerted on the portion of the circular wall by its adjacent sides will have a radial inward component towards the center of the circle that tends to balance the force of the coal pushing out away from the center of the circle. Accordingly, there is no net inward or outward force acting on the circular

\(^{77}\) It is much easier to bend a metal fork than it is to stretch it.

\(^{78}\) *Winans, supra*, note 66 at 331.
container as the outward force of the coal is balanced by the inward component of the
tensile force in the steel. In the words of the claim, every part of the circular container
resists its equal proportion of the load.

Now consider a wall of a rectangular container. This wall has three forces acting on it -
the inward force exerted on it on each side by the adjacent sidewalls, and the opposing
force of the coal against the wall. Select a small portion along the wall and draw a free
body diagram for that portion. For a point in the middle of the portion, one half of the
outward force due to the coal will be acting at a fourth of the length of the portion
towards one edge of the portion (halfway between the midpoint and the end of the
portion) and the other half of the outward force due to the coal will be acting at a fourth
of the length of the portion towards the other edge of the portion. There must be a
balancing inward force. However, only the adjacent portions of the wall can provide this
inward force. As these adjacent portions of the wall are parallel to the selected portion,
any tensile force in them will act perpendicular to the force of the coal. Thus, there is no
tensile strength to resist the outward force of the coal at this portion of the wall. Thus,
the outward force exerted against the wall at this portion will tend to cause bending of
the wall. This is also the case for every other point along the wall. Thus, the wall of a
rectangular container will tend to buckle outwardly.

An octagon, like a rectangle, is rectilinear. Accordingly, in small portions taken from an
octagonal wall, the coal will place an unbalanced force against the wall. However, for
the same dimension of container, the individual walls of an octagonal container will be
much smaller than those of a rectangular container. In rectilinear containers, the
aggregate force exerted by the coal against a wall is balanced by the tensile force
exerted on that wall by its adjacent walls. The problem is that there may be buckling
within individual walls. However, as the bending force is also a function of the distance
between the force and the bending point, resistance to bending increases as the
dimension of the wall perpendicular to the direction of bending diminishes – wide walls
are much more prone to buckling than narrow ones. Accordingly, octagonal walls are
much more resistant to buckling than rectangular ones. Further, only a slight amount of
buckling will distort the octagon into a more circular form. Similarly, a rectilinear
container having a hundred walls would be more resistant to bending than an octagonal
one. At the limit, the number of walls would approach infinity and the dimension of each wall would approach zero until a circular container is reached.

Recall that the claim of the Winans' patent recites a structure — viz. a conical form — and in a clause preceded by "whereby", a couple of functional limitations. Whereby clauses in patent claims have a special meaning. If used in a claim, a whereby clause follows one or more structural limitations and precedes one or more functional limitations. The word "whereby" indicates that the functional limitation is implied by the structural limitations that precede it. In the Winans claim, therefore, the functional limitation that each part of the body of a rail car resists its equal proportion of the load, is, according to the claim, implied by the structural limitation that the body has a conical form. This is, in fact, the case from the perspective of the above-described paradigm. With circular walls, an infinitesimal distance around the circumference of the circle suffices to change the orientation of the wall such that tensile strength in the wall can resist outward loading of the wall.

This mixture of functional and structural limitations suggests that those who wrote the claim thought that more would be involved in its interpretation than simply determining that each element it recites is found in the alleged infringement. The functional limitation suggests a way of seeing the structural limitation and of recognizing that due to the curvature of the conical body, every part of the conical body would have inward tensile forces acting on it to counteract the outward force due to the coal. This way of looking at the conical forms, however, would also reveal the advantages of other forms such as octagonal forms. The combination of the structural and functional limitations invokes a paradigm that helps one to see the octagonal form as the same as the conical form.

Consistent with Putnam's account of meaning, the Supreme Court does not treat the invention as synonymous with the claim in the sense that the claim provides necessary and sufficient conditions for something to be a variant of the invention. Instead, having found that the alleged infringement is the same as the inventive variants identified by the

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79 In contemporary practice, claims often include functional limitations that seem to be implied by the structural limitations in the claims. The use of "whereby" to specifically indicate this relation has, however, fallen out of favour.
inventor, the Supreme Court found there to be infringement despite rail cars having an octagonal body seeming to fall outside the meaning of the claim.

Winans is an unusual case involving mechanical subject matter in that the claim of the Winans patent seems to recite only one element – a conically shaped body of a rail car. In most cases involving mechanical subject matter, the claims will list a number of elements. In deciding these cases, the courts must apply an approach similar to the approach in Winans for each element listed in the claims.

6.2: Gould v. Rees\textsuperscript{80}

Gould v. Rees concerned a patent for an improved steam engine composed of a new combination of old elements. The case does not describe the technology involved, but does provide a good summary of the law. At the trial level, the defendant had asked the judge to

\begin{quote}
"instruct the jury that when a combination of mechanical devices is claimed, the patent is not infringed by the use of a combination differing substantially in any of its parts, and that the omission of one essential feature or element of the combination as claimed avoids the infringement..."\textsuperscript{81}
\end{quote}

The trial judge declined to so instruct the jury, instead instructing them

\begin{quote}
"that the use of a combination is an infringement, and that the omission or one of the elements and the substitution of another mechanical device to perform the same function will not avoid the infringement...[and] that the elements of the machine may be old and the invention consist in a new combination of old elements whereby a new and useful result is obtained."\textsuperscript{82}
\end{quote}

On appeal the Supreme Court held that an invention may consist in a new combination of old elements, but disagreed with the trial judge's instruction to the jury on when such a combination patent would be infringed under the doctrine of equivalents. Instead, the Court held that while

\begin{quote}
"inventors of a combination are as much entitled to equivalents as the inventors of other patentable improvements; by which is meant that a patentee in such a case may substitute another ingredient for any one of the ingredients of his invention if the ingredient substituted performs the same function as the one
\end{quote}

\textsuperscript{80}(1872) 82 U.S. (Wall.) 187.
\textsuperscript{81} Ibid at 192
\textsuperscript{82} Ibid
omitted and was well known at the date of his patent as a proper substitute for the one omitted in the patented combination. It is clear that an alteration in a patented combination which merely substitutes another old ingredient for one of the ingredients in the patented combination is an infringement of the patent, if the substitute perform the same function and was well known at the date of the patent as a proper substitute for the omitted ingredient, but the rule is otherwise if the ingredient substituted was a new one, or performs a substantially different function, or was not known at the date of the plaintiff’s patent as a proper substitute for the one omitted from his patented combination.\textsuperscript{83}

The trial judge’s instruction to the jury failed to distinguish these instances in which the doctrine of equivalent was inapplicable. Accordingly, the judgment was reversed and a new trial ordered.

This decision may reflect a mentalist view of the invention in which the claims are taken to express a correlate picture of the invention in the inventor’s mind. Accordingly, as the inventor could not have known of devices created subsequent to the date of the patent, alleged infringements that substitute these new devices for elements of the claim cannot infringe the claim.

6.3: \textit{Rowell et al. v. Lindsay et al.}\textsuperscript{84}

\textit{Rowell et al. v. Lindsay et al.} regards a combination patent for a cultivator.

Cultivators include a blade or tooth that cuts furrows into the ground, a beam connected to a driving force, such as a horse or a machine, and a shank connecting the tooth to the beam. There is a trade-off in choosing how rigid to make the connection of the shank to the beam. If the shank and the tooth are rigid, then provided they are able to overcome any resistance encountered, a substantially uniform furrow will be cut. If a less rigid shank and tooth are used, then the furrow will be less uniform due to the cultivator yielding to resistance in the soil. However, if a rigid shank and tooth configuration encounters an immovable obstacle, then the shank and tooth will break where a less rigid shank and tooth might yield without breaking.

\textsuperscript{83} \textit{Ibid} at 194.

\textsuperscript{84} (1885) 113 U.S. (10 Otto.) 679.
The patented cultivator adds to the above-described assemblage a curved brace bar that extends from the rear side of the shank – corresponding to the blunt or non-cutting side of the tooth – to the beam. At the beam, the brace bar projects through a brace-receiving slot or mortise, and is held in place by pressure applied by a clamping bolt that acts along the longitudinal axis of the beam. The shank is mounted on a pivot set in the beam. This mounting, combined with the feature that the distance between the pivot mount of the shank on the beam and the brace-receiving slot is substantially equal to the radius of curvature of the curved brace, permits the shank to pivot relative to the beam when the clamping bolt is loosened. Specifically, when the clamping bolt is loosened the shank can be pivoted relative to the beam by sliding the curved brace into and out of the brace-receiving slot. The beam, shank, brace and bolt were all shown in drawings and were identified by reference letters A, B, C and D respectively.

The plaintiffs applied for and received a patent including the following claim:

"Having thus described our invention, what we claim as new, and desire to secure by letters patent, is —
the combination of the slotted beam A, shank B, brace-bar C, and bolt D, when the parts are constructed and arranged to operate as and for the purposes herein specified."

Alleging that a cultivator used by the defendants fell within the scope of this claim, the plaintiffs brought an action for patent infringement. The defendants denied infringement of the patent.

Similar to the Rowell cultivator, as well as to other cultivators, the Lindsay cultivator included a beam, a tooth, and a shank attached to the beam at one end and to the tooth at the other end. At the end attached to the beam, the shank is formed into a curved end, which fits into an extended slot formed in the beam. The curved end has a bore for receiving a threaded bolt D that passes through holes in the beam on either side of the extended slot. From this point fixed to the beam, the shank extends away from the tooth as a result of its curvature, and then comes back through the extended slot as the curved portion ends and the shank straightens out to extend down to the tooth. A second threaded bolt E extends through the beam between the two points at which the shank passes though the extended slot. The threaded bolts D and E can then be tightened to secure the shank within the extended slot.
Unlike the Rowell cultivator, the Lindsay cultivator includes no shaft. However, similar to the Rowell cultivator, the Lindsay cultivator uses a curved member that bears against a bolt to control the give of the tooth and the shank. That is, if the tooth of the Lindsay cultivator encounters an immovable object, the force transmitted to the tooth by the immovable object will tend to make the shank turn about the end fixed to the beam by bolt D. This tendency will initially be resisted by bolt E. However, if the force becomes too great then bolt E will slide towards bolt D in the extended slot, thereby permitting the shank to pivot about bolt D to yield to the immovable object. The curved end of the shank also permits the shank to be set at different angles relative to the beam.

At trial, the plaintiffs' claim for infringement was denied. They then appealed to the Supreme Court. In laying out the test to be followed in determining if the claim was infringed, the Court pointed out that many different cultivators exist, some having braces, and that the *patent of the plaintiffs, therefore, stands on narrow ground, and to sustain it it must be so construed as to confine it substantially to the form described in the specification.*

The plaintiffs' patent was a combination patent in that

"None of the separate elements of which the combination is composed are claimed as the invention of the patentee, therefore none of them standing alone are included in the monopoly of the patent.... But this rule is subject to the qualification, that a combination may be infringed when some of the elements are employed and the others mechanical equivalents are used which were known to be such at the time when the patent was granted."

The defendants contended that their cultivator included neither the brace claimed in the Rowell patent, nor its equivalent, and that therefore they had not infringed the Rowell patent. The plaintiffs argued that the curved end of the shank of the Lindsay cultivator was the equivalent of the brace claimed in their patent. In its judgment, the Supreme Court decided in favour of the defendants.

"The specification and the drawings of the plaintiffs' patent, and the testimony of the plaintiffs' witnesses show that one purpose of the brace-bar, used in the plaintiff's combination, was to strengthen and support the shank between the tooth and the

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85 Ibid at 101.
86 Ibid
beam, the use of the brace-bar enabled the plaintiffs to make the shank with less material, and, at the same time, to increase its strength. This function is not performed by the curved portion of the shank used by the defendants, which has not the slightest tendency to support and strengthen the shank between the tooth and the beam, where the greatest strain comes. ... we find, therefore, that the curved upper part of the shank used by the defendants does not perform one of the material functions of the brace-bar of the plaintiffs' combination. It cannot, therefore, be the equivalent of the latter. For where one... combination is asserted to be an infringement of another, a device in one to be the equivalent of a device in the other must perform the same functions. 87

The Supreme Court may have reached the right result in this case, but their reasoning does not focus on what is important to the invention. To strengthen the shank may have been one of the purposes of the brace, but this purpose was also the purpose of braces in many earlier cultivators. Bracing components against strain is well known. The inventive feature of the plaintiffs' patent was the fact that the brace could be adjusted to change the orientation of the shank relative to the beam, and that at any orientation the curvature of the brace enabled it to slide though the brace slot when the force exerted against the tooth and shank was sufficient to overcome the resistance of the clamping-bolt. The defendants used an element that was different in many ways to achieve the same result. Yet though the element used by the defendant was different, the principles governing its operation were similar: it too relied on a curved portion that no matter what the current orientation of the shank relative to the beam, would continue to act against the bolt E in a direction parallel to the direction in which the bolt E could move within the elongated slot.

In writing the claim of the cultivator patent, no effort was made to distinguish the invention from other things before known. No structural detail was given for any of the four elements listed in the claim. Given that a brace was one of the elements recited, and no details were given about its structure, it is arguable that the patentee invited the court to conclude that an element that performs a bracing function is essential to the invention. While this decision is consistent with a mentalist reading of the claim that requires each of the elements listed to be in any variant of the invention, it is also consistent with an externalist reading of the claims. If the claims are seen as a map that

87 Ibid at 103.
is to guide a skilled reader to the invention while avoiding the prior art, then the claim of the Rowell patent provides little or no guidance. What little guidance provided is from the four elements listed, and it is thus not surprising that the court would rely greatly on these four elements, and, finding the brace to be missing from the alleged infringement, conclude that there was no infringement. A court today would find this claim to be invalid.

6.4: Electric Signal Co. v. Hall Railway Signal Company

Electric Signal Co. v. Hall Railway Signal Company regarded a patent for an electrical signaling apparatus for railroads. This case is sometimes regarded as one of the first cases in which the doctrine of equivalents was invoked to reduce the scope of protection afforded by a claim. When so applied, the doctrine is called the reverse doctrine of equivalents.

The case does not discuss the problems that the signaling apparatus is designed to address. However, from the description of the patented electrical signaling apparatus, as well as from the description of the defendant's impugned activities included in the judgment, it seems that both the plaintiff and the defendant sought to have the presence or absence of a train respectively activate or deactivate the electrical signals. Thus, the devices used by both the plaintiff and the defendant incorporated mechanisms associated with each signal for closing an associated electrical circuit to power the signal when a train was in the vicinity of the signal. When the train left the vicinity of the set of signals, the associated circuit would open to cut the power to the electrical signals.

In the prior art, each signal required its own battery for power. The plaintiff's invention enabled a number of signals to be powered by a single battery. Each single comprises two electro-magnets: one for turning the signal on (the on magnet $M$) and one for turning the signal off (the off magnet $m$). In the plaintiff's invention, each signal has an associated interval of track $a$ of, say, a mile in length. Each interval of track $a$ is electrically isolated from other intervals of track. Two electrical conductors $C$ and $Z$ extend parallel to the track and are attached to a battery. These conductors must be

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88(1885) 114 U.S. 87
89 The interval of track is termed "associated" because this description is made from the reference point of a particular signal. With respect to another signal, there would be a different associated interval of track.
isolated both from each other and from the ground. Electrical conductor C is attached to positive pole of the battery, to one rail of the associated interval of track, and to the same rail of the associated next interval of track $a^1$ (the interval of track that a train would traverse immediately on leaving the associated interval of track). Electrical conductor C is attached to the associated interval of track $a$ via a lead connected to the on magnet $M$, and is attached to the associated next interval of track $a^1$ via another lead connected to the off magnet $m$. Electrical conductor $Z$ is attached to the negative pole of the battery, and to the other rail of the associated interval of track $a$ and the associated next interval of track $a^1$.

When a train is completely off both the associated interval of track $a$ and the associated next interval of track $a^1$, the electrical conductors are completely isolated from each other and the signal does not receive any electrical current. When a train is on the associated interval of track $a$, the wheels and axles of the train form a connection between the opposite insulated rails. As the pair of insulated rails are each connected to either the positive or negative conductor, this closes the circuit permitting current to flow. This current activates the on magnet $M$ of the signal, turning the signal on. When the train proceeds to the next interval of track, this procedure will be repeated with respect to the next signal. This next interval of track is the associated next interval of track $a^1$ with respect to the signal first mentioned. Thus, as the positive conductor $C$ is connected to a rail of the associated next interval of track $a^1$ via a lead connected to the off-magnet, the departure of the train from the associated interval of track and its arrival on the next interval of track both opens the on magnet circuit, and closes the off magnet circuit, thereby cutting off current to the on magnet $M$ and permitting current to flow to the off magnet $m$. The off magnet $m$ then turns the signal off. When the train leaves the associated next interval of track $a^1$, both the on magnet circuit and the off magnet circuit will be open, such that this signal will not be draining any charge from the battery.

The patent included the following claims:

"1. The battery $B$, in combination with the positive and negative conductors $C$ and $Z$, two or more electro-magnets, $M$, $M'$, $M''$, for actuating or causing to be actuated visual or audible signals, and two or more circuit-closers, $a$, $a^1$, $a^2$, placed at intervals along the line of a railroad, substantially as and for the purposes specified."
2. The battery $B$, in combination with the positive and negative conductors $C$ and $Z$, two or more electro-magnets, $m$, $m^1$, $m^2$, for releasing or reversing visual or audible signals, and two or more circuit-closers, $a^1$, $a^2$, placed at intervals along the line of a railroad, substantially as and for the purpose specified.

3. The battery $B$, in combination with the positive and negative conductors $C$ and $Z$, circuit closer $a$, and the electro-magnet $M$, for actuating a visual or audible signal, with the circuit-closer $a^1$, wires 5, 7 and 8, and electro-magnet $m$, for reversing, releasing, or stopping said signal, substantially as specified.\(^{90}\)

One problem with the plaintiff's device is the conductors $C$ and $Z$ must necessarily extend for great distances. As any conductor, no matter how conductive, will have some resistance, some electrical power will be lost in the conductors $C$ and $Z$ whenever a circuit is closed. This power loss will be much greater at signals that are farther from the battery as the total resistance is, in part, a function of the length of the conductors. Accordingly, to ensure that there is enough power to activate the magnets of distant signals, more current must be used than is required for near signals. However, this current may generate too much power in the nearer signals, thereby destroying them.

To overcome this problem, the plaintiff's patent teaches adjusting the resistance of each circuit to account for this difference. Thus, relatively high-resistance leads will connect the conductors to the near signals, so as to dissipate an amount of power approximately equal to the amount of power that would be dissipated in the electrical conductors for farther signals.

The defendant's device addressed the same problem that is addressed by the plaintiff's device — viz. the need for separate batteries for each signal. In the defendant's device, the negative pole of the single battery used is connected to the earth. The positive pole is connected to a conductor $C$ that parallels the track. A conductor $Z$ parallels the track along the same stretch that conductor $C$ does. Conductor $Z$ is open at the end closest to the battery and is connected to earth at the opposite end. These conductors are isolated from each other. Each signal of the defendant's device has an on magnet for turning the signal on, and an off magnet for turning the signal off. A circuit-closer is placed on the track at a point near the signal such that the action of a train running over the circuit closer connects the conductors $C$ and $Z$ via a lead connected to the on magnet, thereby

\(^{90}\) Electric Signal Co., supra, note 88 at 91.
powering the on magnet and turning the signal on. At the next signal, the train runs over two circuit-closers, one of which closes the circuit for the on magnet of the next signal, and the other of which closes the circuit for the off magnet of the first-mentioned signal, thereby turning on the next signal and turning off the first-mentioned signal. Unlike the plaintiff's device, no current is supplied to the rails. Instead, it is merely the action of the train that closes a circuit that is entirely isolated from the track.

The Supreme Court found that the first question to be considered

"on the issue as to infringement is whether insulated sections of the rails, as circuit-closers, constitute an essential element in the combinations described in the patent. And that question we are constrained to answer in the affirmative."91

This decision is based on the fact that the patentee refers repeatedly to insulated sections of track a, a1, a2 throughout the disclosure portion of the patent specification:

"the use of insulated sections of the railroad track thus repeatedly appears in every part of the specifications as an unchangeable and characteristic feature of the invention, and there is nothing in the state of the art at that date, as disclosed in the evidence, to show that the patentee would have been justified in applying, or that if he had applied, an application would have been sanctioned by a grant of a patent for a combination as large and undefined as that now claimed by implication and construction, so as to cover every form of circuit-closer then known or thereafter invented. For that employed by the defendant as part of the Hall system, was not only not known and in use at the date of the patent, but was a device invented by Hall himself or one by Snow, for which the latter obtained a patent dated October 2, 1873 [slightly after the date of the patent in suit and therefore unknown at the time of the plaintiff's invention]. It dispenses altogether with the use of insulated sections of the rack, and employs instead a separate instrument placed near the track, and worked by means of a lever connected with the track, so that the wheels of the locomotives and cars passing on the track depress the outer end, the lever being raised again and held up after the train has passed by means of a spring, which holds it in place."92

When the plaintiff drafted the claims, he seemed to have in mind that means other than the one he had chosen could be used to close the circuits, as his claims recite circuit closers a, a1, a2, despite these reference characters referring to insulated intervals of track in his description of his invention. Thus, it seems clear that he intended his patent

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91 Ibid at 96.
92 Ibid at 97 to 98
to cover other means of closing circuits, and that he knew that other means existed.

Contrary to the Supreme Court's conclusion that

"there is nothing in the state of the art at that date, as disclosed in the evidence, to show that the patentee would have been justified in applying, or that if he had applied, an application would have been sanctioned by a grant of a patent for a combination as large and undefined as that now claimed by implication and construction, so as to cover every form of circuit-closer then known..." 93

there is every reason to think that the plaintiff not only would have been justified in seeking a patent of this scope, but was in fact successful in seeking a patent of this scope given the claims of the issued patent. This part of the Supreme Court's judgment is, of course, obiter, as the defendant's circuit-closer was not "then known" at the time of the plaintiff's invention. The material issue is whether the plaintiff should be allowed to extend his patent to cover means of closing circuits that were not known at the time of his invention. In this case, the Supreme Court held that the doctrine of equivalents could not extend the construction of a patent claim to cover something that was not known at the date of invention. In subsequent cases, the Supreme Court has reversed this position.

In addition to the foregoing reasons, the Supreme Court found for the defendant because, unlike the circuits closed in the plaintiff's device, all of the circuits in the defendant's device included substantially the same combined length of the conductors C and Z. As a result, the resistance of the circuits due to the length of the conductors was constant regardless of the distance of the signal from the battery - as the length of conductor C increases with increasing distance from the battery, the length of conductor Z diminishes. This solved the problem with the patented device that different amounts of power are required for signals depending on their distance from the battery.

Arguably, this case reflects an externalist reading of the claim. The term "circuit-closers" recited in the claims seems to extend to the alleged infringement. However, instead of reading this claim to apply to the alleged infringement and therefore to be infringed, the Supreme Court looks at the circuit closers in the disclosed device and in the alleged infringement, and finds them to be unlike. That is, consistent with Putnam's account of meaning, the Supreme Court does not treat the invention as synonymous with the claim

93 Ibid
in the sense that the claim provides necessary and sufficient conditions for something to be a variant of the invention. Instead, having found that the alleged infringement is not the same as the inventive variants identified by the inventor, the Supreme Court found that there was no infringement despite the alleged infringement seeming to fall within the meaning of the claim.

Alternatively, the case may reflect a mentalist view of the invention. From this perspective, the claims are taken to express a correlate picture of the invention that inhabits the inventor’s mind. As discussed above, the circuit-closers in the alleged infringement were not known at the date of the patent in suit. Further, the circuit-closers solve the problem of the different lengths of the circuit found in the patented device. For these reasons, the Supreme Court would conclude, reasonably enough, that the correlate picture of the invention held in the inventor’s mind could not have extended to the alleged infringement.

This case is no longer good law. Some inventions will be made in areas where future advances are likely to attend any sustained research. To hold, as was held in this case, that the claims cannot apply to such advances is to render patent protection in such areas effectively useless. Any competitor could avoid a patent by designing a new component and using it instead of a component that was known at the date of the patent. Since this decision, the Supreme Court has come to recognize this fact.

6.5: Dryfoos v. Wiese

Dryfoos v. Wiese regarded a patent for an improvement in quilting machines. Before commencing the action, the plaintiff obtained a first and second re-issue of the patent in order to get a broader first claim. The plaintiff then brought an action for patent infringement against the defendant alleging infringement of claims 1 and 2 of the second re-issue patent – claim 2 of the re-issue patent was former claim 1, and the broadest claim, of the original patent.

The improvement in quilting machines devised by the plaintiffs enabled a quilting machine to be used for frusto-conical articles of clothing, such as skirts. His invention

\[94(1887) 124 U.S. 32.\]
\[95 A frustum of a cone is obtained by truncating the cone to remove its pointed end.\]
relied on conical rolls to feed the conical bodies of skirts and skirt-borders in a circular direction. The broadest claim of the original patent, which became claim 2 of the re-issue patent, was directed to the specific mechanism for feeding the frusto-conical articles of clothing to the machine. Afterwards, the plaintiff sought to cover other mechanisms for feeding frusto-conical articles of clothing to the machine by adding claim 1 of the second re-issue. Claims 1 and 2 of the second re-issue are as follows:

"1. In a machine for quilting conical strips of goods, the combination, with the series or gang of sewing mechanisms and the cloth-plate which supports the goods under the action of the same, of a feed device operating intermittently in the intervals between the formation of the stitches, which extends and operates substantially across, or from edge to edge of, the conical strip of goods, and which, as it departs from the shorter curved edge and approaches the longer curved edge of said goods, is adapted to have a proportionately increased range of feed-movement, substantially as and for the purposes set forth.

2. The combination, with a series of vertically reciprocating needles mounted in a laterally reciprocating sewing-frame, of conical feed-rolls, and mechanism for causing them to act intermittently during the intervals between the formation of stitches, substantially as herein shown and described. [emphasis added]"\r

When the italicized element of the second claim, the conical roll, receives conical goods such as a skirt, it performs the function recited in the italicized portion of the first claim: viz. "as it [the conical roll] departs from the shorter curved edge and approaches the longer curved edge of said goods, [it] is adapted to have a proportionately increased range of feed-movement". The reasons for the plaintiff wanting this broader claim are clear from the impugned activities of the defendant.

At trial and on appeal, the defendant was found to have

"engaged in using a quilting machine for quilting conical goods, [the quilting machine] having a gang of needles, and short cylindrical feed-rollers at each edge of the goods, which they feed in a circular direction, by moving at different rates of speed constantly..."\r

Accordingly, while the defendant arguably did not use the conical roll of claim 2, the short cylindrical feed-rollers moving at different rates of speed do have a proportionately

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96 Dryfoos, supra, note 94 at 35 to 36.
97 Ibid at 34.
increased range of feed-movement as they depart from the shorter curved edge and approach the longer curved edge of the conical goods. Accordingly, the defendant's device seems to fall within the scope of claim 1.

At trial, the Circuit Court for the Southern District of New York found the inventor "to have meritoriously invented effective means for giving circular direction to the feed of quilting machines.... He set forth these means in the specifications and drawings of his original patent and seems to have been well entitled to then have a patent for them....But he does not appear to have been entitled to a patent for merely giving such direction to such feed-motion apart from the mechanism for giving such direction to such feed-motion....He invented his own mechanism, and the combination of that with the cooperating parts of the machine, and nothing more; and seems to have been entitled to a patent for those and no more....The second re-issue...was, in effect, for the combination of the gang of needles and cloth-plate with any feeding mechanism which would reach across the cloth and feed the long side faster than the other. This was, clearly, beyond the invention shown in the original, and, except as to the mechanism shown in the original, beyond the invention in every way. The claim of the re-issue [claim 1] is, therefore, wholly invalid."

The trial court determined that claim 2 was valid as it was restricted to the particular mechanism of the patented invention. However, the trial court found that the defendant's machines did not infringe claim 2 as these machines did not have "conical rollers, nor any of the other mechanisms of the plaintiff; that what the defendant did was not to divide the plaintiff's conical feed-rollers into sections of parts, in such manner as to make the parts the equivalent of the whole; but that the plaintiff's machine gave the circular direction to the goods by mechanism which accomplished the result in one way, while in the defendant's machines the result was accomplished by different mechanism in a different way."

On appeal, the plaintiff seems to have given up on claim 1 of the re-issue, guessing, probably correctly, that this claim would not be any more favorably received by the Supreme Court than it had been by the trial court. Instead, he chose to rely wholly on claim 2 of the re-issue.

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98 Ibid at 35.
99 Ibid at 36.
The judgment does not describe the plaintiff’s argument that claim 2 was infringed; however, this argument can be reconstructed by looking at the trial decision and specifically at the trial court’s determination that the cylindrical feed rollers of the defendant’s device had not been obtained by simply dividing the plaintiff’s conical feed-rollers into sections of parts. The frustrum of a cone can be wholly defined by two circles that are spaced apart along an axis they both share. If those two circles are then rotated at the same rpm, the larger circle will impart a greater speed to cloth on its surface as this tangential speed is obtained by multiplying the rpm of the circle by its radius. Abstracting from the size of the circle, then, what is required is to move the larger edge of a conical piece of cloth faster than the smaller edge, which can as easily be achieved by using circles of the same radii at different rpm as it can by using circles of different radii at different rpm.

In its judgment, the Supreme Court simply concludes that the defendant’s mechanism differs from the plaintiff’s mechanism, and that as the patent does not cover all mechanisms for achieving the same result as the claimed mechanism, claim 2, though valid, is not infringed. This decision is consistent with a mentalist perspective on claims – the claim recited elements such as conical feed rolls that are not found in the alleged infringement. There is no suggestion that the correlate picture of the invention held by the inventor extended to the pair of cylindrical feed rolls found in the alleged infringement. Accordingly, there could be no infringement.

While being consistent with a mentalist view of the invention and the claim language, this decision may not be inconsistent with an externalist view of claim language. Unlike the claims of the Winans patent, the elements recited in the Dryfoos claim do not seem to be evocative of a paradigm. Using conical feed rollers to feed frusto-conical elements of clothing does not seem to involve the application of a scientific theory that enables pairs of cylindrical rollers rotating at different rpm to be seen as like a single conical roller. Put another way, there does not seem to be any agreement in the form of life of the relevant mechanical arts that two cylindrical rollers of equal radius that rotate at different rpm are the same as a single frustro-conical roller. This lack of agreement is evinced by the lack of a language game that the inventor can use to draft claims extending to both two cylindrical rollers of equal radius that rotate at different rpm and a single frustro-conical roller. This may seem unfair to the plaintiff in Dryfoos. His solution may well have been
just as difficult if not more difficult than the solution taught by the Winans patent, so why should he be entitled to any less protection merely because his does not come with an already developed theory. However, it is a fact that because the solution taught by the Winans patent comes with an already developed theory expressive of agreement about what is like a conical container in relevant respects, variants of the Winans invention will be readily apparent to those skilled in the art. The difference between the Winans and Dryfoos inventions depends not only on what is in the respective inventors' minds. It also depends on facts about the forms of life in which the inventions arise.
CHAPTER SEVEN: FUNCTIONAL LIMITATIONS

While technological terms may often seem to refer to something structural, what they refer to is often determined by function. Thus, in the case of a heat pump, the heat exchangers, compressor and expansion valve are all determined by function. This may not be obvious as these terms have over time become names for classes of device that are suitable for performing these functions. Thus, in Rowell the United States Supreme Court seemed to regard the term "brace" as structural while at the same time relying on the bracing function to determine if something falls within the scope of the term. Sometimes a court will recognize the functional character of an ostensibly structural term. Recall the United States Supreme Court's treatment of the term circuit closers in Electric Signal Co. – the Court limited the scope of this term to the mechanism disclosed in the patent.

Generally, courts treat with disfavour elements of claims that are defined using functional language. In such cases, the offending claims are often invalidated for overbreadth. Thus, in Dryfoos, the court held that a claim that included functional language was invalid for claiming more than had been invented. However, the courts are not consistent. In Machine Co., a claim that defined the invention in utterly functional terms was held to be valid and infringed. Winans provides a good example of the kinds of language the court prefers; the elements should be described completely in structural terms although functional results of this structure may also be claimed, and may actually broaden the scope of the claim. In this chapter, two cases in which the United States Supreme Court invalidates claims written using transparently functional language are considered.

7.1: General Electric Co. v. Wabash Appliance Corp. et al.100

In General Electric, the Supreme Court sought to reconcile conflicting decisions in the Circuit Courts of Appeal regarding the recital of functional limitations in the claims to define the limits of the claimed invention. The invention at suit related to a tungsten filament for incandescent lamps.

Early advances in the field in incandescent lighting involved the use of a carbon filament and not a tungsten filament. Advances in incandescent lighting led to the discovery that
the tungsten filament is more luminous than the carbon filament when conducting an electrical current. However, tungsten filaments suffer from a couple of drawbacks.

In both the carbon filament and the tungsten filament, there is some heating of the filament accompanying the use of the light due to the resistance of the filament to the electrical current conducted. As a result of this heating, the tungsten filament forms crystals, which extend across the entire diameter of the filament and are substantially perpendicular to the longitudinal dimension of the filament. These crystals tend to slip laterally relative to each other, thereby reducing the cross-sectional area of the filament at the location of the crystals. This reduction of the cross-sectional area of the filament increases its resistance to the electrical current, thereby increasing the heating during use and hastening the eventual burn out of the filament. This problem was well known in the art and was termed "offsetting".

During use, the tungsten filament elongates and is thereby forced out of the plane it occupies between its fixed supports. If the tungsten filament is forced out of alignment to such an extent that it touches the glass, then the light burns out. This problem was well known in the art and was termed "sagging". Some solutions had been devised, but none had enjoyed unmitigated success. Specifically, including additional supports to constrain the realignment of the filament as a result of sagging, may cool the filament and reduce its efficiency.

Another solution to the problem of sagging seems to have been to the use of course-grained tungsten for the filament. When heated, this course-grained tungsten would form large crystals, thereby inhibiting sagging. However, "course-grained and thus non-sagging filaments meant 'offsetting' to the art where it was 'common knowledge' that grains large enough to extend across the filament induced slippage."\textsuperscript{101} Accordingly, the problems of sagging and offsetting were related as the available solution to the former, worsened the latter.

As a result of much experimentation, Pacz, an employee of the plaintiff General Electric, discovered a way of simultaneously addressing both of these problems, thus making

\textsuperscript{100}(1937) 304 U.S. 364.
\textsuperscript{101} Ibid at 367.
incandescent lighting using tungsten filaments more viable. Through experimentation, Pacz found that both sagging and offsetting could be substantially prevented by combining an alkaline silicate with tungsten. The resulting tungsten filament,

"whether it be due to the fact that the grains have not reached the equilibrium grain size or to other causes, is particularly susceptible to grain growth during subsequent heat treatments. The probable reason why filaments made according to my invention do not sag is that the structure is comparatively coarse grained. The coarse grained filament produced by means of my invention does not 'offset' so as to cut short the life of the lamp appreciably."\(^{102}\)

At trial, the claims were held to be valid and infringed. On appeal to the Court of Appeals for the Second Circuit, the claims were held to be invalid as anticipated by an earlier patent. This latter result conflicted with the conclusion reached by the Court of Appeals for the Ninth Circuit in a parallel case\(^{103}\) that the same claims were valid and infringed. The Supreme Court granted certiorari to resolve this conflict.

The Supreme Court found claim 25 of Pacz's patent to be representative of all of the claims:

"A filament electric incandescent lamps or other devices, composed substantially of tungsten and made up mainly of a number of comparatively large grains of such size and contour as to prevent the substantial sagging and offsetting during a normal or commercially useful life for such a lamp or other device."\(^{104}\)

The Court did not consider whether the Pacz invention was anticipated or rendered obvious as they found that all of his claims were invalid on their face. First, Pacz had failed, in the claims, to particularly point out and distinctly claim the part, improvement, or combination, which he claimed as his invention or discovery. That the tungsten filament is primarily composed of comparatively large grains distinguishes it from some of the prior art, but does not distinguish it from early versions of the tungsten filament, which had large, regular grains that were subject to offsetting. The only words that might distinguish it from the prior art was the functional limitation requiring the grains to be "of such size and contour as to prevent substantial sagging and offsetting during a normal

\(^{102}\) Ibid at 367.
\(^{103}\) Ankrum v. General Electric Co. (1935) 80 F.2d 958
\(^{104}\) Supra, General Electric Co. note 100 at 368.
or commercially useful life\textsuperscript{105} of the lamp. These words were found to be insufficient to distinguish the invention from the prior art:

"A limited use of terms of effect or result, which accurately define the essential qualities of a product to one skilled in the art, may in some instances be permissible and even desirable, but a characteristic essential to novelty may not be distinguished from the old art solely by its tendency to remedy the problems in the art met by the patent. And we may doubt whether the language in claim 25, taken by itself, conveyed definite meaning to those skilled in the art of incandescent lighting.\textsuperscript{106}

Accordingly, the patent was invalid.

The Circuit Court of Appeals below had commented that it would have been prohibitively difficult for the inventor to define the microscopic and heterogeneous character of the crystals in detail.\textsuperscript{107} However, the Supreme Court noted that

"Congress requires, for the protection of the public, that the inventor set out the definite limitation of his patent; that condition must be satisfied before the monopoly is granted. The difficulty in making adequate description may have some bearing on the sufficiency of the description attempted, but it cannot justify a claim describing nothing new except perhaps in functional terms. It may be doubted whether one who discovers or invents a product he knows to be new will ever find it impossible to describe some aspect of its novelty.\textsuperscript{108}

Imagine the position of Pacz and General Electric, after Pacz has determined that combining alkaline silicate with the tungsten has the above-described effect on the tungsten filament, thereby overcoming the problems of offsetting and sagging. They wish to obtain a patent for the invention. However, if the patent protection obtained is only for combining alkaline silicate with the tungsten of filament, then it will probably be ineffective - once Pacz shows the way by describing his invention, others will probably be able to follow by adding different materials to the tungsten. If, instead of being directed to the specific material added to the tungsten, the claims are directed to the coarse grained structure of the resulting tungsten, then the scope of the claims will be

\textsuperscript{105} Ibid.
\textsuperscript{106} Ibid, at 372. The court commented in a footnote that there had been no evidence that those in the art would have interpreted the functional limitation to refer to the grains having irregular boundaries or having regular boundaries that are not perpendicular to the longitudinal axis of the filament.
\textsuperscript{107} Ibid, at 372.
\textsuperscript{108} Ibid.
expanded as they will cover every way of achieving this coarse grained structure, regardless of which material is added. However, the inventor refers to the coarse grained structure of the tungsten as only the probable reason for the lack of sagging and offsetting. It is likely that both he and General Electric fear that this explanation is not wholly correct. If so, then they will also fear that others who take the time to carefully investigate the phenomenon described in the patent will learn that the mechanism by which the inventive result is achieved is somewhat different from what is claimed and disclosed in the patent. Once others have learned this, they may be able to invalidate the claims for extending to inoperable subject matter, or, where the claims do not extend to all of the operable subject matter, they may be able to circumvent the claims.

In a footnote to its judgment, the Supreme Court comments that the plaintiff has failed to show that one skilled in the art would have interpreted the functional limitation requiring the grains to be "of such size and contour as to prevent substantial sagging and offsetting during a normal or commercially useful life" to refer to grains having irregular boundaries or having regular boundaries that are not perpendicular to the longitudinal dimension of the tungsten filament. This suggests that the Supreme Court might have considered claims that refer to these structural features to be sufficiently definite for validity. Yet as discussed above, this requirement makes it very difficult to obtain patent protection for a new development that is not yet fully understood.

On the other hand, it is difficult to see what purpose is accomplished by including claims like the above-quoted claim 25 in the patent. If the language game of patent claims exists to give patent applicants the incentive to increase their knowledge of the innovation so that others cannot circumvent the protection provided by the claims, and to give competitors the incentive to increase their knowledge of the innovation to find errors in the inventor's understanding that will enable the competitors to circumvent the patent protection, then the Supreme Court was right to invalidate the claims. Drafting such claims does not require the inventor to develop a deep understanding of the invention, nor does the language of the claim encourage competitors to develop a deep understanding of the invention as regardless of how much better the competitors understand the invention than the inventor, they will still be unable to circumvent the protection afforded by the claims.
In both *Evans* and *Machine Co.*, functional language had to be used in the claims as the invention rested on the recognition of the value of a new function. Once this recognition had occurred, many different mechanisms could be used to achieve this function. In *General Electric Co.*, the invention was based on a structure largely not comprehended by the inventor. Aware of his lack of comprehension, the inventor added functional language to try and capture the essence of the invention to which he could not point in structural terms. If the inventor had succeeded and the claim been upheld, then General Electric would have had the same right as it would have had it known of an aspect of the invention that would have helped to guide others to other variants of the invention. It seems fair that given how much less it is disclosing to the public that the right General Electric obtains should be similarly circumscribed.

This judgment may be read as consistent with an externalist picture of language and with a picture of the invention as a paradigm rather than as an abstract entity determined by rules. Pacz has found a solution to the problems of sagging and offsetting in tungsten filaments. However, this solution, at least as claimed, is not fruitful in the sense that it does not provide Pacz or others with a direction of research to pursue to discover other solutions to these problems. Pacz knows how he achieves his tungsten filament, but does not know or claim what it is about his tungsten filament that makes it better. Without this knowledge there is no way that he or others can recognize other tungsten filaments as like or unlike his tungsten filament. That is, there is no agreement in judgment about what is like or unlike his tungsten filament in relevant respects. Without such agreement in judgment, the form of life that gave rise to his tungsten filament cannot support a language game for referring to what is like or unlike his tungsten filament in relevant respects. Put another way, Pacz's invention as claimed is not a paradigm as it is not a solution to a problem that suggests other ways in which it can be usefully applied. For this reason, Pacz is unable to come up with a claim that covers these other solutions without including the functional limitation "...to prevent the substantial sagging and offsetting during a normal or commercially useful life for such a lamp or other device."109

By means of the claims, Pacz must provide a map for the territory of the invention. Other than the combination of alkaline silicate and tungsten disclosed in the patent, Pacz
has no idea of what else might work. He thinks that his combination may work because the resulting grains have irregular boundaries or regular boundaries that are not perpendicular to the longitudinal dimension of the tungsten filament, but he is hesitant to have the protection afforded by the patent depend on this structural feature. As a result, the claims he writes provide a map of no value to those skilled in the art – it does not tell them how to determine other combinations that are like the disclosed combination in relevant respects. The claims are accordingly invalid.

The judgment is also consistent with a mentalist view of the claims and the invention. According to this view, the inventor's mind holds a correlate picture of his invention. In this case, Pacz is not sure why his invention works – he has hit upon a solution to a problem without appreciating the underlying conceptual basis for the solution. Thus, the correlate picture of his invention in his mind is very limited in extent. The claims he writes seek to cover more than the correlate picture of his invention covers, and the Supreme Court accordingly finds the claims to be invalid.

7.2: Haliburton Oil Well Cementing Company v. Walker et al. 110

Haliburton Oil regarded a patent (the Walker patent) covering means for measuring the location of obstructions in oil wells. At trial, and at the Circuit Court of Appeals, the claims were found to be valid and infringed. On appeal to the Supreme Court, the defendant attacked the validity of the claims for failing to define the structure of the invention.

In order to efficiently pump oil from oil wells, the distance between the top of the well and the fluid surface of the oil must be known. In the case of oil wells having a corkscrew configuration of machinery, the distance between the top of the well and the fluid surface of the oil cannot be measured by using a rope or cable. Accordingly, for these types of well, there was no way of measuring this distance.

A possible solution to this problem appeared to be to measure the time that sound took to bounce off obstructions and return to the surface. An expired patent disclosed an apparatus for measuring distance in a tubular space in which a noise-making device,

109 Ibid at 368.
110(1946) 71 U.S.P.Q. 175.
such as a gun, is triggered and the noise directed into the tubular space. The returning echoes from the tubular space agitate a diaphragm, which moves a stylus to record on a piece of paper the variant movement of the diaphragm caused by its response to the echo waves.

A prior patent sought to apply the device disclosed in the expired patent to oil wells. The patented apparatus included a gas cylinder having a valve for admitting a short blast of gas into a well. The returning echo waves could then be recorded by using a microphone, an amplifier, and a diaphragm/stylus combination for recording the echoes. The success of this patent required the speed of sound in the oil well to be known. In the patent, the speed of sound was assumed to be about 1,100 feet per second. This assumption turned out to be wrong. As a result, the prior patented apparatus did not solve the problem of how to measure the distance between the fluid surface of the oil and the top of the oil well. Given the uncertainty regarding the speed of sound in an oil well, some way of calibrating the echo-measuring device was required.

Say that there is some portion of the well that is of known length, and that echoes are received from both the top and the bottom ends of this portion of the well. Then the speed of sound in at least that portion of the well can be determined by measuring the difference in time that echoes from each end of this portion take to return to the surface. Specifically, the speed of sound will be twice this known distance divided by the time difference.

All flow pipes include tubing collar or joints. The distance between tubing collars will always be known – this is the length of a tubing section, which is the same at different wells. If the echo from each of the tubing collars can be recorded, then the number of tubing collars can be determined. The total length of the pipe can then be determined, as can the speed of sound in the pipe. Using the speed of sound in the pipe, the distance to the fluid surface of the oil can then be determined.

In order for the echoes from tubing collars in the pipe to be recorded, some amplification of only these echoes is required as they are typically too faint to be reliably recorded. Walker achieved this amplification by using a well-known device – a mechanical acoustical resonator. His resonator was a short pipe having a resonance frequency
attuned to the frequency of the tubing collar echo waves. Accordingly, this resonator tends to preserve these echoes while damping out other echoes. This resonator is only one of many means that Walker could have used to accomplish his purpose. In order to cover all of these means, his claims use functional language to define the inventive element of his invention that distinguishes it from the prior art. Both parties and the court treated claim 1 as representative of all of the claims in terms of its reliance on functional language:

“1. In an apparatus for determining the location of an obstruction in a well having therein a string of assembled tubing sections interconnected with each other by coupling collars, means communicating with said well for creating a pressure impulse in said well, echo-receiving means including a pressure responsive device exposed to said well for receiving pressure impulses from the well and for measuring the lapse of time between the creation of the impulse and the arrival at said receiving means of the echo from said obstruction, and means associated with said pressure responsive device for tuning said receiving means to the frequency of echoes from the tubing collars of said tubing sections to clearly distinguish the echoes from said couplings from each other [emphasis added]”

The italicized portion of the foregoing claim refers to any member of a class of objects including the short pipe resonator described in the patent specification that distinguishes the tubing collars echoes from echoes from other sources. From the claim, it seems that the inventor thought of his invention as the recognition that this function could advantageously be provided in an apparatus for measuring distances in oil wells. He does not appear to have thought of his invention as being limited to the specific short pipe resonator disclosed in the patent.

What the inventor seems to have considered his invention to be is something that the Supreme Court held could not possibly be an invention. In the words of Justice Black for the Supreme Court

“the language of the claim... describes this most crucial element in the new combination in terms of what it will do rather than in terms of its own physical characteristics or its arrangement in the new combination apparatus. We have held that a claim with such a description of a product is invalid as a violation of [the statutory requirement]...that 'in the case of a machine, he [the inventor]...shall particularly point out and distinctly claim the

111 Ibid at 178.
part, improvement, or combination which he claims as his invention or discovery.”

From the Justice Black’s perspective, an invention must be a specific mechanism. Far from promoting technological development, claims that use broad functional language to define the element that distinguishes the invention from the prior art will inhibit it:

“In this age of technological development there may be many other devices beyond our present information and indeed our imagination, which will perform that function and yet fit these claims. And unless frightened from the course of experimentation by broad functional claims like these, inventive genius may evolve many more devices to accomplish the same purpose…. Yet if Walker’s blanket claims be valid, no device to clarify echo waves, now known or hereafter invented, whether the device be the actual equivalent of Walker’s ingredient or not, could be used in a combination such as this, during the life of Walker’s patent.

Had Walker accurately described [claimed] the machine he claims to have invented, he would have no such broad rights to bar the use of all devices now or hereafter known which could accent the waves….Certainly, if we are to be consistent with Rev. Stat. 4888, a patentee cannot obtain greater coverage by failing to describe his invention than by describing it as the statute commands.”

Justice Black does not seem to have in mind the reverse doctrine of equivalents in the foregoing comments. Applying the reverse doctrine of equivalents, a device that falls within the literal meaning of the claim, but is not the equivalent of Walker’s short pipe resonator, would not infringe the patent.

This decision is akin to the decision of the trial court in Dryfoos that claim 1 of the second re-issue patent was invalid because the patentee was entitled to protection only for the specific mechanism taught by the patent, and not for other mechanisms that might perform the same function. However, the decision differs from the Dryfoos decision in that in Dryfoos it is arguable that other mechanisms for performing the claimed function were not known at the date of the patent, whereas that was not the case with the Haliburton Oil claim – other mechanisms for amplifying echoes from the tubing collars must have been well known. If so, this decision is inconsistent with the holding in Gould that it

112 Ibid at 178 to 179.
is clear that an alteration in a patented combination which merely substitutes another old ingredient for one of the ingredients in the patented combination is an infringement of the patent, if the substitute perform the same function and was well known at the date of the patent as a proper substitute for the omitted ingredient...."114

The 1952 Patent Act includes a new provision, enacted by Congress in response to this decision. Section 112, for which there is no corresponding provision in the 1870 Act, provides that:

"an element in a claim for a combination may be expressed as a means or step for performing a specified function with the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and the equivalents thereof."

If this provision had been in force when Haliburton was decided, then the Court would have been forced to consider whether or not the electric filter used by the defendants to enhance the echoes received from the tubing collars, was the substantial equivalent of the short pipe resonator that provided this function in the patent. In Dryfoos, the Court would have considered whether two co-axial cylinders of equal diameter rotating at different rpm was the equivalent of a frustrum of a cone rotating at constant rpm. However, as this was precisely what was recited in claim 2, which was held to be valid, the Court did consider this question and found these two mechanisms not to be equivalent. If this is a fair sample of the Court's reasoning, then little115 or nothing is gained by the amendment. In addition to his broad claim, Walker could have drafted a dependent claim that recited the short pipe resonator. The Court, after finding the broad claim to be invalid, would then have had to go on to consider whether an electronic filter or amplifier is the equivalent of a short pipe resonator, and would in all likelihood have found that an electronic filter is not the equivalent of a short pipe resonator.

113 Ibid at 180.
114 Gould, supra, note 80 at 194.
115 This amendment may make it more convenient for claim drafters. Specifically, if the drafter of the Walker claims had been aware of how the claims were likely to be construed, then he might have been able to provide adequate protection by writing separate independent claims for each mechanism for amplifying the echoes received from the tubing collars. This would have required a very large number of independent claims, and would have diminished the readability of the patent considerably. With section 112 of the 1952
From his decision, it is clear that Justice Black’s reasoning is based on a perspective about innovation that differs from the perspective of individual or corporate innovators. Individual or corporate innovators would not usually bother trying to come up with a new machine, product, process or composition of matter that is only as good for its intended purpose as what has previously been used. Instead, innovators try to come up with inventions that achieve new results or that achieve old results in a way that is superior to the existing technology. In contrast, Justice Black seems to be concerned that if the claims of this patent are enforceable, then competitors will have no incentive to develop alternatives to the short pipe resonator. In fact, there were many alternatives to the short pipe resonator already, and there would have been no incentive to develop new ones except to accomplish their function in some way that is superior to the amplification achieved by the amplifiers previously available. Further, given the many uses of amplifiers, the incentive to develop these new amplifiers would remain even if the claim had been held to be valid. In fact, it is common practice for corporations to acquire patents that are so deep in their competitors’ fields of expertise that the corporation owning the patent would never be able to use what they have patented without infringing many of their competitors’ patents. The incentive to develop this technology remains as if the improvement is significant, and lies in the path of the competitors’ course of development, the competitors may be forced to deal with the owner of the patent. Of course, the competitors have probably also sowed the research waters ahead of their competitors with their own patents.

Justice Black’s perspective is also clearly mentalist in nature in that he would limit the invention to the specific mechanism that the inventor has in mind. With this approach, it is impossible to properly recognize the contribution that the inventor has made. Imagine Walker’s position when he realizes that there is a way of determining the speed of sound in oil wells, such that the distance from the fluid surface of the well to the top of the well can be determined from the time that sound takes to traverse this distance. He does not know how to amplify the echoes received from the tubing collars, but he knows that

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Patent Act, the drafter could instead merely disclose these variants in the specification and then rely on a means clause in the claim to refer to them all.

116 Except where they are trying to circumvent the claims of a current patent.

117 This is not always the case. Some companies will obtain patents for marketing reasons or to secure financing, and not because they think that the patent actually covers valuable technology. However, a company that obtains a patent for this reason, or conducts research to obtain such a patent, is not going to be dissuaded by a competitor’s patent as there is no intention to actually practice the invention.
others have this expertise. To implement his invention, he needs to interact with others to take advantage of their expertise, which he lacks. This does not limit his ability to implement his invention, however, as he is able to secure their assistance without difficulty. Walker retains a mechanically inclined expert who suggests that Walker use a hollow pipe designed to have a resonance frequency at the frequency of echo waves from the tubing collars. Using this hollow pipe, Walker is able to implement his invention. He knows, however, that there are probably many ways to amplify echoes of a given frequency, and drafts his claims accordingly.

The foregoing account of the process by which Walker implemented his invention suggests that this invention must be understood in externalist terms. Walker does not have a correlate picture of his invention in mind as the invention depends for its operation on elements whose inner workings are unknown to Walker. That these elements are largely not understood is unimportant, provided that he knows how to interact with others to implement his invention. Walker knows that any variant of his invention must incorporate a mechanism for amplifying echoes of a certain frequency. The claims reflect this knowledge. Thus, the claims reflect Walker's ability to interact with others so as to implement his invention in the external world.

What is important in these cases is not that functional language is used, but what the invention is and whether the claims guide interaction with others and the external world to obtain variants of the invention. As shown in General Electric, functional language in the claims can be used to hide an inventor's lack of knowledge regarding the preconditions for the invention to work. The General Electric claims provide no guidance on how to interact with others to implement the invention. These claims might have provided such guidance if they had referred to the filament comprising grains having irregular boundaries or regular boundaries that are no perpendicular to the longitudinal dimension of the filament. However, the inventor was not sure that these directions would accurately reflect the agreement that would arise in the form of life of the tungsten filaments and thus was unwilling to rely on them.

The decisions in both Haliburton Oil and Dryfoos seem to turn on the character of the limitations found in the claims. That is, claim 1 of the Dryfoos patent and the claims of the Walker patent were invalid for using functional limitations at the point of invention.
However, the role that functional language plays in claims varies widely. This general conclusion is clearly too broad, due to the decision in *Machine Co.* among others. Further, even the cases in which the Supreme Court has found claims to be invalid for including functional limitations at the point of invention, the circumstances vary so much that there is little that the cases have in common. In *Haliburton Oil*, the functional language was directed to a means for amplifying echoes of a certain frequency. Many apparatus for performing this function already existed as it could usefully be applied in many different contexts. Further, paradigms existed for the development of new apparatus for performing this function. In contrast, there is no indication that the cloth-feeding mechanisms allegedly covered by the functional language at issue in *Dryfoos* were known beforehand. That is, based on the knowledge in the relevant skilled community, the *Haliburton Oil* claims provide instructions that enable one to interact with others to implement the invention using an electronic filter, while it is not apparent that the *Dryfoos* claims provide instructions that enable one to interact with others to implement the invention using two cylinders that rotate at different rpm

In *Haliburton*, Justice Black invalidates the claim instead of simply finding that it was not infringed. In contrast, the decision in *Electric Signal Co.* simply found that the term "circuit-closer" did not extend to the circuit-closer in the alleged infringement. By this decision, Justice Black appears to be adhering to a mentalist view of language in this decision – he regards the claim as stipulating necessary and sufficient conditions for the invention. Given this view, it is not open to him to find that the claim is valid and not infringed. To find for the defendant, he must find that the claim is invalid. Arguably, he would have to decide similarly in any case involving a claim that uses functional language to define one of its elements. Otherwise, applying a mentalist view of language, he would have to find that devices that were clearly different from a device claimed in functional terms in a patent, but perform the same function as the patented device, infringe the patent. Justice Black's unreasonably narrow view of inventions may be a consequence of his mentalist view of language.
An important aspect of Kuhn’s and Wittgenstein’s externalist picture of language involves seeing language as part of a form of life instead of seeing it as providing a conceptual structure that underlies all forms of life. Our use of language depends on our agreement in judgment in relation to aspects of our forms of life. For example, for us to use the word “wheel”, we must in large measure agree on how to apply the word “wheel” in our forms of life. That is, we must substantially agree on what we can call a wheel, and must also agree on how the word “wheel” is to be in conjunction with related words such as “axle”. Language is used to point to something about which there is agreement.

According to this view, the business of understanding others’ words involves determining the aspects of our forms of life to which those words refer. Individual words or clauses may be ambiguous as there are many areas of agreement in our forms of life to which those words or clauses may refer. However, when those individual words or clauses are assembled into sentences, and those sentences themselves occur in specific contexts, the potential for ambiguity is much reduced as many of the possible uses of individual words or clauses considered on their own cannot be their use in the context of the sentence in which they occur. Each of the different parts of a sentence may point in more than one direction; however, to find the use of the sentence as a whole it is only necessary to find that place to which different parts of the sentence point.

It is often the case that some parts of a sentence may be erroneous or vague, such that there is no form of life to which all parts of the sentence point. However, the other parts of the sentence may still point to the same form of life. Then, the person seeking to understand the sentence can look at the incongruities in the sentence and make a reasonable guess as to whether an error was made, and even sometimes as to what error was made.

From a mentalist view of language, it is much more difficult to see how a listener can still understand the speaker despite errors in what is said. According to this view, underlying the speaker’s words is a picture in the speaker’s mind that the speaker is trying to communicate to the listener. If the listener has no prior acquaintance with this picture,
then the listener will have no way of determining if part of what the speaker says is wrong, unless what the speaker says as a whole is logically inconsistent.

Based on the foregoing, one would expect claims containing errors to be read differently depending on whether they are read from a mentalist or an externalist viewpoint. Specifically, if claims are read from an externalist viewpoint, then many errors in the claims will not mislead a skilled reader. However, if a claim is read from an mentalist viewpoint, then errors in the claim will mislead a skilled reader unless the claim as a whole is inconsistent, in which case the claim is likely to be invalid. In the case discussed below, the Court seems to bring an externalist view of language to the claims.

8.1: Mowry v. Whitney

Sometimes claims fail to distinguish between the invention and inoperable subject matter by failing to define a boundary where one ends and the other begins. At other times, claims may identify the wrong boundary, such that the claim is unstartly narrow or covers inoperable subject matter. The same rules of claim construction are applicable whether determining if the claims are infringed or if they are valid. In Mowry, the U.S. Supreme Court considered whether claims covering the manufacture of railway car wheels were invalid either for obviousness or for extending to inoperable subject matter.

Different demands are placed on different portions of wheels for railway cars. The periphery or tread of a wheel that runs over the rail must be very hard or it will wear out. In contrast, there is no need for the interior portions of the wheel, and especially the hub, to be very hard as the surfaces of these portions of the wheel do not come into contact with the rail. Unlike the tread, however, the interior portions of the wheel include elongated sections that carry the weight of the railway car and are accordingly subject to strain. These interior portions must therefore be extremely strong.

Due to the metallurgical properties of iron, there is an inevitable trade-off between its hardness and strength. Iron can be very hard only when in a state of laminated crystallization, and in that state iron is brittle. In contrast, when in a state of granulated crystallization, iron is both soft and very strong. Iron that is cooled very rapidly will cool into a state of laminated crystallization, whereas iron that is cooled more slowly will cool
into a state of granulated crystallization. Accordingly, different rates of cooling are required for different portions of the wheel.

To solve this problem, means were devised for cooling the tread more rapidly than the remaining portions of the wheel by placing the tread against highly conductive material while surrounding the interior portions of the wheel with less conductive materials. Thus, the tread lost heat and cooled more rapidly than the interior portions resulting in the tread being hard and brittle and the interior portions soft and strong. Unfortunately, this solution introduced new problems to wheel manufacture.

When iron is cooled from a molten state it shrinks. In casting a solid wheel, molten iron is poured into a mould at the hub, and flows though the mould to the tread. The iron in the tread shrinks as it cools. Concurrently, the iron in the interior portions of the mould cools more slowly and thus remains in a liquid or semi-liquid state and does not shrink. Thus, as the iron in the tread cools and shrinks, the iron in the interior portion remains in a liquid state and is incapable of resisting the shrinkage of the tread. When the interior portions eventually cool and shrink, they become too short to span the interior dimension of the wheel. This is a particularly serious problem with the spokes, which are likely to fail due to the tensile strain induced by their shrinkage.

In 1848, Whitney filed a patent application for an improved method of manufacturing cast-iron railway wheels, which he describes as follows:

"My improvement consists in taking railroad wheels from the moulds in which they are ordinarily cast, as soon after being cast as they are sufficiently cool to be strong enough to move with safety, or before they have become so much cooled as to produce any considerable inherent strain between the thin and thick parts, and putting them in this state into a furnace or chamber that has been previously heated to a temperature as high as that of the wheels when taken from the moulds. As soon as they are deposited in this furnace or chamber, the opening through which they have been passed is closed, and the temperature of the furnace or chamber, and its contents, gradually raised to a point a little below that at which fusion commences, when all the avenues to and from the interior are closed and the whole mass left to cool no faster than the heat it contains permeates through, and radiates from the exterior surface of the materials of which it is composed. By this process all parts of each wheel are raised.
to the same temperature, and the heat they contain can only pass off through the medium of the confined atmosphere that intervenes between them and the walls of the furnace or chamber; consequently, the thinnest and thickest parts cool and shrink simultaneously together, which relieves them from all inherent strain whatever when cold." 

Whitney claims this invention as follows:

"I do not claim to be the inventor of annealing castings made of iron or other metal, when done in the ordinary way; nor do I claim to be the inventor of any particular form or kind of furnace, in which to perform the process. But what I do claim as my invention and desire to secure by letters patent is the process of prolonging the time of cooling, in connection with annealing railroad wheels, in the manner above described; that is to say, the taking them from the moulds in which they are cast, before they have become so much cooled as to produce such inherent strain at any part as to impair its ultimate strength, and immediately after being thus taken from the moulds, depositing them in a previously-heated furnace or chamber, so constructed, of such materials, and subject to such control that the temperature of all parts of the wheels deposited therein may be raised to the same point (say a little below that at which fusion commences), when they are allowed to cool so fast, and no faster than is necessary for every part of each wheel to cool and shrink simultaneously together, and no one part before another." 

In 1864, the defendant Mowry began manufacturing wheels using reheating similar to the process disclosed in Whitney's patent:

"A layer of charcoal having been laid on the perforated bottom of the annealing pit, the wheels, as they are turned out of the moulds red hot, are placed in the pits, with a layer of charcoal between each wheel, a layer of charcoal being laid on the uppermost wheel, and on this a perforated metal plate is laid. The charcoal, becoming now agitated by the hot wheels, the cover of the pit is then laid on, and the damper opened so as to admit just sufficient air to effect the combustion of the contained charcoal, in the space of seventy-two hours, less or more, as may be found necessary for the annealing operation." 

Whitney brought an action of patent infringement against Mowry. Mowry responded by denying infringement and by impeaching the validity of the claims of Whitney's patent for obviousness and lack of utility. The U.S. Supreme Court determined that Whitney's

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119 Ibid at 626 to 627.
120 Ibid at 628 to 629.
patent was valid and infringed. Only the issue of the validity of the patent will be considered here.

In attacking the validity of the claims for obviousness, Mowry pointed out that the process of annealing was well known and argued that annealing railway wheels was analogous to previous applications of annealing and was therefore obvious. In response, Whitney pointed out that annealing had never before been used in the manufacture of cast iron railway car wheels, and that there was no dispute that this process solved longstanding problems in this manufacture. In its judgment, the Supreme Court noted that annealing was well known for many purposes prior to the date of the invention. However,

"it does not appear that...the idea existed of making a car-wheel with chilled tread, straight plates, and slid hub, annealed, and cooled so as to leave it uninjured by the strain attendant upon the unequal cooling of the thick and thin parts....In all the experiments made for annealing other castings the object sought was different, and in them all, as well as in the process described in the publications given in evidence, the effect upon the annealed metal or glass was not to leave them in the condition in which it was sought to bring the car-wheels, with the crystallization or chill of the periphery unimpaired, and the plate or thin part unaffected by strain."122

Accordingly, the Court held that the patented Whitney process for manufacturing cast iron rail car wheels was unobvious.

Mowry also challenged the validity of the Whitney patent on the grounds that the process claimed lacked utility. Specifically, Mowry pointed out that if after chilling of the tread, the wheel were reheated to the maximum temperature mentioned in the claim – a temperature a little below that at which fusion commences – then the effect of the chill on the tread would be lost as the iron of the tread would no longer be in a state of laminated crystallization. Further, as the tread along with the rest of the wheel would then be cooled slowly, the tread would not return to a state of laminated crystallization, which requires rapid cooling.

In its decision, the Court noted that it is true

121 Ibid at 629 to 630.
"that the fusing-point of cast iron is in the neighborhood of 2786 degrees of Fahrenheit, twelve to fifteen hundred degrees above the point at which, according to the evidence, the chill of the tread of a car-wheel would be destroyed. If, therefore, the process patented to Whitney, requires, after the removal of the wheel to the heated furnace or chamber, the application of a degree of heat closely approximating the point of fusion, it must be conceded that instead of being beneficial it is positively hurtful."123

As it was clear that Whitney had practised his invention to advantage for many years, Mowry was not asserting that the invention as practised lacked utility, but rather that the invention as claimed lacked utility as the maximum reheating temperature specified in the claim was so high as to include inoperable subject matter within the scope of the claim.

In noting that the specification and claims of a patent are directed to one having skill in the art, and that the unskilled may not be able to apply the invention on reading the specification, the court also noted that

"the definiteness of a specification must vary with the nature of the subject. Addressed as it is to those skilled in the art, it may leave something to their skill in applying the invention, but it should not mislead them. The objection here is that in describing the degree of heat to be applied after the wheels have been deposited in the heated chamber the patentee states it to be such that the temperature of all parts of the wheels 'may be raised to the same point (say a little below that at which fusion commences),' and the defendant insists that this amounts to a direction to raise the heat to a degree that must destroy the chill of the tread, and thus render the casting valueless as a railroad car-wheel. But it is obvious that only vague and uncertain directions could have been given respecting the extent to which the heat is necessary to be raised....That, in the nature of things, must be left to the judgment of the operator."124

If the claim is read with the objects of the invention in mind, then its language is sufficiently definite. It is not

"a fair construction of the patentee's language to hold that it requires the heat to be raised in all cases to a degree only a little below the point of fusion. He does not attempt to give any more

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122 Ibid at 640.
123 Ibid at 643.
124 Ibid at 644 to 645.
definite direction than that all parts of the wheel must be raised to the same temperature, suggesting in a parenthesis ("say a little below that at which fusion commences"). He fixes a maximum. The heat must not reach the point of fusion, and the prescribed minimum is that degree where the heat of the different parts of the wheel is equal. Within those limits the degree is left open to the judgment of the operator, and within those limits it is clear from the evidence that the process may be applied without injury to the chill."

I think that this claim was incorrectly drafted. Instead of the maximum temperature being specified to be a little below that at which fusion occurs, it should have been specified to be a little below that at which the iron of the tread would change phase from laminated crystallization. This is no less definite than the language actually used – both the fusion temperature and the phase change temperature of a metal are metallurgical properties that depend on the composition of the metal. The direction provided is still vague and uncertain to some extent, as the maximum reheat temperature is not a given but instead must be determined by a skilled operator.

In the context of the judgment, it does not matter whether the maximum reheat temperature specified is merely vague or frankly wrong as the Supreme Court adopts an explicitly externalist approach and the maximum reheat temperature specified is not going to mislead a skilled reader of the claim. In its judgment, the Court treats the claim as if it is to provide instructions to an operator. Due to the nature of the technology, these instructions are vague and uncertain to some extent. The inventor does not have a correlate picture of the world that enables him to define in complete detail how the invention is to be implemented. Instead, the inventor is able to cooperate with others, most particularly the operator on whose judgment everything depends, to implement the invention. The judgment of this skilled operator will, in turn, depend on his observations regarding the behaviour of the metal as different maximum reheat temperatures may be appropriate at different times as the behaviour of the steel will vary. Thus, both the implementation of the invention and the use of the words of the claims that point to this implementation require interaction with others and with the external world.

125 Ibid at 646.
CHAPTER NINE: THE LIMITS OF THE DOCTRINE OF EQUIVALENTS
While claims provide guidance to those skilled in the art about the extent of the invention, and thus should be read from the perspective of those skilled persons, some of the terms in a claim are included not so much to cover the invention as to avoid the prior art. These terms may be found in narrower, dependant claims that provide fallback protection in event that the broader claims are invalidated, and also may be added to broad claims during the prosecution of the patent application before the relevant patent office. If the doctrine of equivalents is allowed to apply in an unrestricted way to these terms of the claim, then these claims may be found to extend to the prior art that the drafter sought to avoid by including the terms. Accordingly, the doctrine of equivalents must recognize that the construction of terms of a claim must be balanced by the fact that too broad a construction of these terms is inconsistent with their role in distinguishing what is claimed from the prior art.

In the following two cases the doctrine of equivalents is applied to claims including terms that were, in the first case, added to dependent claims, and, in the second case, were added during prosecution of the patent application to avoid the prior art. In the second case, the importance of an element-by-element analysis in determining if there is infringement under the doctrine of equivalents is emphasized.

9.1: Graver Tank & Manufacturing Co., Inc., et al. v. The Linde Air Products Company
Graver Tank regarded a patent for an electrical welding process. The four claims at issue covered a flux or compound for use in the welding process. Since its inception, this case has consistently been cited as providing the test for applying the doctrine of equivalents.

The four claims at issue covered a flux containing a combination of alkaline earth metal silicate and calcium fluoride. These claims are not reproduced in the judgment. The defendant's impugned flux contained manganese silicate – in fact, it was 88.49% manganese silicate by weight. Unlike calcium and magnesium, manganese is not an alkaline earth metal. Thus, the issue to be resolved was whether manganese silicate was the equivalent of an alkaline earth metal silicate.
In its judgment, the Supreme Court outlined at length the reasons for the doctrine of equivalents:

"to permit imitation of a patented invention which does not copy every literal detail would be to convert the protection of the patent grant into a hollow and useless thing. Such a limitation would leave room for—indeed encourage—the unscrupulous copyist to make unimportant and insubstantial changes and substitutions in the patent, which, though adding nothing, would be enough to take the copied matter outside the claim and hence outside the reach of the law…. Outright and forthright duplication is a dull and very rare type of infringement. To prohibit no other would place the inventor at the mercy of verbalism and would be subordinating substance to form. It would deprive him of the benefit of his invention and would foster concealment rather than disclosure of inventions, which is one of the primary purposes of the patent system."127

The doctrine focuses on the function provided, the way it is provided and the result achieved to determine if there is infringement:

"to temper unsparing logic and prevent an infringer from stealing the benefit of an invention, a patentee may invoke this doctrine to proceed against the producer of a device if it performs substantially the same function in substantially the same way to obtain substantially the same result. 128

The doctrine may be used to argue both for and against infringement:

The wholesome realism of this doctrine is not always applied in favour of a patentee, but is sometimes used against him. Thus, where a device is so far changed in principle from a patented article that it performs substantially the same or a similar function in a substantially different way, but nevertheless falls within the literal words of the claim, the doctrine of equivalents may be used to restrict the claim and defeating the patentee’s action for infringement."129

The foregoing quotes do not provide much information on how to decide if the doctrine of equivalents should apply in a particular case. The Supreme Court writes that

"what constitutes equivalency must be determined against the context of the patent, the prior art, and the particular circumstances of the case. Equivalence in the patent law is not

126 Graver Tank, supra, note 2.
127 Ibid at 330.
128 Ibid.
129 Ibid.
the prisoner of formula and is not an absolute to be considered in a vacuum. It does not require complete identity for every purpose and in every respect. In determining equivalents, things equal to the same thing may not be equal to each other and, by the same token, things for most purposes different may sometimes be equivalent. Consideration must be given to the purpose for which an ingredient is used in a patent, the qualities it has when combined with other ingredients, and the function which it is intended to perform. An important factor is whether persons reasonably skilled in the art would have known of the interchangeability of an ingredient not contained in the patent with one that was.\textsuperscript{130}

At trial, the court had reviewed many publications indicating that manganese silicate was known to perform similarly to alkaline earth metal silicates in fluxes. The court had also heard testimony to the same effect from many expert witnesses. On the basis of this evidence, the trial court had determined that manganese silicate was an equivalent of the alkaline earth silicates recited by the claim, and, consequently, that the defendant's flux infringed the plaintiff's patent.

A finding of equivalence is a determination of fact based on the evidence. It is not a function of the Supreme Court to independently evaluate the evidence and make its own determination regarding equivalents. The Supreme Court should not disturb the finding regarding equivalence of the trial judge unless this finding is clearly erroneous. Far from the trial judge's finding being clearly erroneous in this case, the Supreme Court commented that it

"is difficult to conceive of a case more appropriate for the application of the doctrine of equivalents. The disclosures of the prior art made clear that manganese silicate was a useful ingredient in welding compositions. Specialists familiar with the problems of welding compositions understood that manganese was equivalent to and could be substituted for magnesium in the composition of the patented flux and their observations were confirmed by the literature of chemistry.\textsuperscript{131}\textsuperscript{131}

Accordingly, the finding by the trial judge of infringement under the doctrine of equivalents was upheld by the Supreme Court.

\textsuperscript{130} Ibid at 330 to 331.
\textsuperscript{131} Ibid at 332
Despite the Supreme Court's view that it "is difficult to conceive of a case more appropriate for the application of the doctrine of equivalents”, Justices Black and Douglas dissented. These justices would have placed far more emphasis on the wording of the claims:

"The claim is a statutory requirement, prescribed for the very purpose of making the patentee define what his invention is; and it is unjust to the public, as well as an evasion of the law to construe it in a manner different from the plain import of its terms. Giving this patentee the benefit of a grant that it did not precisely claim is no less 'unjust to the public' and no less an evasion of R.S. § 4888, merely because done in the name of the 'doctrine of equivalents.'"

Elsewhere, Justice Black writes of the majority's judgment as amounting to the "emasculating" or "sterilization of Acts of Congress".\

In his dissent, Justice Black looks to whether the patentee would have intended these claims to cover fluxes including manganese silicate.

"Several of their claims which this court found too broad to be valid encompassed manganese silicate; the only claims found valid did not. Yet today the Court disregards that crucial deficiency, holding those claims infringed by a composition of which 88.49% by weight is manganese silicate.

In view of the intense study and experimentation of the respondent's assignors with manganese silicate, it would be frivolous to contend that the failure specifically to include that substance in a precise claim was unintentional. Nor do respondents attempt to give that or any other explanation for its omission. But the similar use of manganese in prior expired patents, referred to in the Court's opinion, raises far more than a suspicion that its elimination from the valid claims stemmed from fear that its inclusion by name might result in denial or subsequent invalidation of respondent's patent."\

Generally, narrower claims are included in a patent to deal with an eventuality in which the broader claims are found to be invalid. Thus, the limitations included in the narrower claims that are missing from the broader claims must be considered to be essential to the invention as claimed in the narrower claims, as without these additional limitations, the narrower claims must succumb to a validity attack that succeeds against the broader

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132 Ibid at 333.
133 Ibid at 332.
134 Ibid at 333.
claims. In particular, competitors should be entitled to assume that limitations in narrower claims will not be so broadly construed as to extend to subject matter explicitly recited in the broader claims. Otherwise, the patentee would be entitled to a more generous interpretation of the claims for the purposes of validity, than the competitors are for the purposes of infringement.

In his dissent, Justice Black does not write that the patent could not have contained a valid claim that covered the defendant’s flux; instead he merely writes that the patent did not include such a claim and that there is reason to think that the patentee had good reason to avoid covering manganese silicate in its narrower claims. In contrast, Justice Douglas writes that the in the judgment, the doctrine of equivalents

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    “which is said to protect against practicing ‘a fraud on a patent’
    is used to extend a patent to a composition which could not be patented. For manganese silicate had been covered by prior patents, now expired. Thus we end with a strange anomaly: a monopoly is obtained on an unpatented and unpatentable article.”
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It seems unlikely that the facts on which Justice Douglas bases his decision are correct, as it was well established more than a hundred years before this case that a patentee could not through the patent appropriate the prior art. Justice Black raises a more interesting point regarding the interpretation of limitations in dependant claims. However, the majority could also make the point that the fact that manganese silicate was covered in a broader claim found to be invalid should make the court more willing to apply the doctrine of equivalents as the defendant could not say that it did not have notice of the plaintiff’s claim over this subject matter. Yet how much notice is provided to a defendant by a claim that the defendant is confident it can invalidate?

In this case, the Supreme Court seems to be adopting an explicitly externalist view of the invention that is revealed in the way that the test for applying the doctrine of equivalents is structured. The trial court had heard evidence from many expert witnesses that manganese silicate would perform similarly to the alkaline earth metal silicates recited in the claims. Thus, the court was free to conclude that the term “alkaline earth metal silicates” pointed to an area of agreement in judgment in a metallurgical form of life, such that those having relevant skill would agree that manganese silicate is like alkaline earth
metal silicates for all relevant purposes. Thus, the meaning or use of the term “alkaline earth metal silicates” depends on interaction with others and interaction with the world to determine what is alike in the relevant respects.

In contrast, Justice Black seems to adopt a mentalist view of the invention and the language of the claim. He writes that the claims should be restricted to the plain import of their terms. This begs the question of how to determine the plain import of the terms of a claim. However, given that he is dissenting from the majority, who referred to expert witnesses to help them to determine the use of the terms of the claim, Justice Black is probably taking the position that the plain import of terms should be determined solely by some definition of these terms. That is, he seems to be holding that the meaning of the claims can be understood by one who knows the definitions of all of terms of the claim. Interaction with others and with the world is not necessary to determine how a claim should be used.

Justice Black’s dissent is not limited to this point, however. He also points out that the inventor had not utterly neglected to claim manganese silicate, but rather had recited this element in some of the claims, all of which were subsequently found to be invalid. This point brings up considerations that must be taken into account in any reading of the claims, whether externalist or mentalist. While those skilled in the art would consider manganese silicate to be the same as the alkaline earth metal silicates recited in the claims, there are countervailing reasons to find that manganese silicate is not the same as the alkaline earth metal silicates recited in the claims. These reasons stem from legal principles of claim construction. Patent applicants include narrower claims in the application to guard against the chance that the broader claims will not be allowed, or will subsequently be found to be invalid. These narrow claims contain limitations that are missing from the broader claims. For the narrow claims to accomplish their object, these additional limitations must be able to save the narrower claims from invalidity in the event that the broader claims are found to be invalid. Thus, these additional limitations are of fundamental importance. Falling back on the map metaphor, the map provided by a narrow claims should have clear instructions not to step into the territory that seems to have been given up by adding the limitation, as the purpose in having the

135 Ibid at 334.
narrow claim in the first place is to deal with situations in which the broader claims have been invalidated for including this territory.

The foregoing analysis is oversimplified, as narrower claims will often differ from broader claims by many limitations. Individual limitations on their own may make little sense and may not support an argument that the narrower claim is valid despite the broader claims from which it depends being invalid. Thus, individual limitations may not be sufficient to point out the territory to be avoided. In the present case, the claims were not included in the judgment. Without more information about how the narrower claims considered in the case differ from the broader claims found to be invalid, it is impossible to say if the fact that the narrower claims do not recite manganese silicate while the broader claims do should provide a bright line over which the doctrine of equivalents cannot extend.

9.2: Warner-Jenkinson Co. v. Hilton Davis Chemical Co.136
Between the Graver Tank decision in 1950 and the Warner-Jenkinson decision in 1997, the doctrine of equivalents was developed by the Circuit Court of Appeals. During this period, many inconsistencies in the case law emerged. The Warner-Jenkinson decision helped to resolve some of these inconsistencies.

Warner-Jenkinson regarded a patent covering an improvement in an ultra-filtration process. During the patent application process, a prior patent was cited (the Booth patent) that disclosed the process as claimed in the patent application. The Booth filtration process occurred at a pH137 of over 9.0, and, as the claims of the patent application did not limit the process to any pH range, the Booth filtration process anticipated the process claimed in the patent application. In response to the citation of the Booth patent, the applicant amended the claims to restrict the filtration process to a pH range of 6.0 to 9.0. The amended claims no longer applied to the Booth patent and were therefore allowed. The relevant portions of the claims of the issued patents read as follows:

“In a process of the purification of a dye... the improvement which comprises subjecting an aqueous solution ... to ultrafiltration through a membrane having a nominal pore

136 (1997) 520 U.S. 17, 41 USPQ (2d) 1865
137 “pH” is an abbreviation for “power of hydrogen”, and is a measure of the acidity or alkalinity of a solution. A solution is alkaline when it has a pH over 7.0, and is acidic when it has a pH lower than 7.0. At a pH of 7.0, the solution is neutral.
diameter of 5-15 Angstroms under a hydrostatic pressure of approximately 200 to 400 p.s.i.g., at a pH from approximately 6.0 to 9.0, to thereby cause separation of said impurities from said dye.”

After the patent issued, the defendant Warner-Jenkinson Co. developed an ultrafiltration process that operated at a pH of 5.0, but in other respects fell under the wording of the claimed process. At trial the plaintiff Hilton Davis conceded that there was no literal infringement, and relied entirely on the doctrine of equivalents. The issue of equivalents, an issue of fact, was sent to the jury who found that the defendant had infringed the patent under the doctrine of equivalents. However, the jury found that the defendant’s infringement had not been intentional, and accordingly awarded the plaintiff only a fifth of the damages sought.

This decision was affirmed by a badly split twelve judge Court of Appeals for the Federal Circuit. A majority of seven judges held that the doctrine of equivalents depends on whether there are substantial differences between the patented and impugned processes. Four of the five dissenting judges held that the doctrine of equivalents allowed an improper expansion of claim scope, thereby preventing the claims from providing notice to public of the limits of the invention. The remaining dissenting judge, Justice Nies, held that the doctrine of equivalents should be applied on an element-by-element basis in order to reconcile its application with the public notice function of claims. On appeal, the Supreme Court favoured Justice Nies’ approach to the doctrine of equivalents.

The defendant advanced a number of different arguments for why it did not infringe the claims. First, the defendant argued that the doctrine of equivalents as it had developed was inconsistent with the legislative requirement that patentees define their inventions. The Supreme Court did not accept this argument. However, while finding that the doctrine of equivalents had survived revisions to the Patent Act by Congress, the Supreme Court expressed concern

“that the doctrine of equivalents, as it has come to be applied since Graver Tank, has taken on a life of its own, unbounded by the patent claims. There can be no denying that the doctrine of equivalents when applied broadly, conflicts with the definitional intent of the Patent Act.”

138 Warner-Jenkinson, supra, note 136 at 1868.
and public-notice functions of the statutory claiming requirement. Judge Nies identified one means of avoiding this conflict:

'A distinction can be drawn that is not too esoteric between substitution of an equivalent for a component in and an invention and enlarging the metes and bounds of the invention beyond what is claimed....

Where a claim to an invention is expressed as a combination of elements, as here, ‘equivalents’ in the sobriquet ‘Doctrine of Equivalents’ refers to the equivalency of an element or part of the invention with one that is substituted in the accused product or process.

This view that the accused device or process must be more than ‘equivalent’ overall reconciles the Supreme Court's position on infringement with its concurring statements that ‘the courts have no right to enlarge a patent beyond the scope of its claims as allowed by the Patent Office.’... The ‘scope’ is not enlarged if courts do not go beyond the substitution of equivalent elements.'

We concur with this apt reconciliation of our two lines of precedent. Each element contained in a patent claim is deemed material to defining the scope of the patented invention, and thus the doctrine of equivalents must be applied to individual elements of the claim, not to the invention as a whole. It is important to ensure that the application of the doctrine, even as to an individual element, is not allowed such broad play as to effectively eliminate that element in its entirety."

In addition to deciding how the doctrine of equivalents should be applied to the claim as a whole, the Court also considered what could be an equivalent. In particular, the Court departed from its earlier decisions that only that which was known to be equivalent to a claimed element on the application date of the patent can be caught by the doctrine of equivalents. Instead, the Court held that

"a skilled practitioner’s knowledge of the interchangeability between claimed and accused elements is not relevant for its own sake, but rather for what it tells the factfinder about the similarities or differences between those elements. Much as the perspective of the hypothetical “reasonable person” gives content to concepts such as “negligent” behaviour, the perspective of a skilled practitioner provides content to, and limits on, the concept of ‘equivalence’. Insofar as the question under the doctrine of equivalents is whether an accused element is equivalent to a claimed element, the proper time for evaluating equivalency – and thus knowledge of interchangeability between elements – is at the time of

139 Ibid at 1871.
infringement, not at the time the patent was issued. [Emphasis added]”\textsuperscript{140}

The part of this quote that is not italicized is an explicit avowal of an externalist view of language. The meaning of a term in a claim depends on the range of equivalents for that term. The range of equivalents for that term depends on the knowledge of an expert. The knowledge of this expert is important because it provides information about the relevant part of the world - about what is the same and what is different. Thus, the meaning of terms depends on interaction with others and on interaction with the world.

Considered on its own, the italicized portion of the foregoing quote is somewhat misleading. Despite the fact that the proper time for evaluating equivalency is the date of infringement, during the patent application process the applicant may inadvertently limit the claims from ever being construed to cover an element that would otherwise have been caught by a construction of the claims under the doctrine of equivalents.

At trial and on appeal, the defendant had argued that even if the doctrine of equivalents would otherwise have applied to bring the defendant’s process within the scope of the claims, the claims could not be given this construction because of amendments made during the prosecution of the application. In other words, if the claims as originally drafted had included the limitation that the filtration process occur at a pH range between 6.0 and 9.0, then the doctrine of equivalents might apply to extend these claims to a filtration process occurring at a pH of 5.0. However, where this limitation is added during the prosecution of the patent application, the claims can no longer apply to any filtration process occurring outside the pH range of 6.0 to 9.0.

In its judgment, the Supreme Court held that prosecution history estoppel applied only where the claims had been amended to

“avoid the prior art, or otherwise to address a specific concern – such as obviousness – that arguably would have rendered the claimed subject matter unpatentable.\textellipsis

In this case, the Patent Examiner objected to the patent claim due to a perceived overlap with the Booth patent, which revealed an untrafiltration process operating at a pH above 9.0. In response to this objection, the phrase ‘at a pH from approximately 6.0 to 9.0’ was added to the claim. While it is

\textsuperscript{140} Ibid at 1874.
undisputed that the upper limit of 9.0 was added in order to
distinguish the Booth patent, the reason for adding the lower
limit of 6.0 is unclear....Thus, while a lower limit of 6.0, by its
mere inclusion, became a material element of the claim, that did
not necessarily prevent the application of the doctrine of
equivalents as to that element....Where the reason for the change
was not related to avoiding the prior art, the change may
introduce a new element, but does not necessarily preclude
infringement by equivalents of that element."\textsuperscript{141}

This does not completely get the patentee off the hook for amendments, however, as a
reason for amendments must be provided for the court to determine if prosecution
history estoppel applies.

"In our view, holding that certain reasons for claim amendment
may avoid the application of prosecution history estoppel is not
tantamount to holding that the absence of a reason for an
amendment may similarly avoid such an estoppel. Mindful that
claims do indeed serve both a definitional and a notice function,
we think the better rule is to place the burden on the patent
holder to establish a reason during patent prosecution. The court
then would decide whether that reason is sufficient to overcome
prosecution history estoppel as a bar to the application of the
doctrine of equivalents to the element added by amendment.
Where no explanation is established, however, the court should
presume that the patent applicant had a substantial reason related
to patentability for including the limiting element added by
amendment. In those circumstance, prosecution history estoppel
would bar the application of the doctrine of equivalents as to that
element."\textsuperscript{142}

In this case, the plaintiff had not provided any reasons for the amendment, and the
Supreme Court accordingly remanded the case to the Federal Circuit to determine if
reasons existed for the amendment that would permit the application of the doctrine of
equivalents.

In the same judgment in which it restricted judicial discretion in the application of the
doctrine of equivalents by requiring it to be applied on an element-by-element basis, the
Supreme Court also expanded judicial discretion in choosing "the linguistic framework
under which equivalence is determined."\textsuperscript{143} According to the Supreme Court

\textsuperscript{141} \textit{Ibid} at 1872.
\textsuperscript{142} \textit{Ibid} at 1873.
\textsuperscript{143} \textit{Ibid} at 1875.
"the particular linguistic framework used is less important than whether the test is probative of the essential inquiry: Does the accused product or process contain elements identical or equivalent to each claimed element of the patented invention? Different linguistic frameworks may be more suitable to different cases, depending on their particular facts. A focus on individual elements and a special vigilance against allowing the concept of equivalence to eliminate completely any such elements should reduce considerably the imprecision of whatever language is used. An analysis of the role played by each element in the context of the specific patent claim will thus inform the inquiry as to whether a substitute element matches the function, way and result of the claimed element, or whether the substitute element plays a role substantially different from the claimed element."

In this case, the Supreme Court did not apply the doctrine of equivalents, but rather clarified the circumstances in which the doctrine of equivalents would be applicable, as well as the limits on the doctrine of equivalents. For patentees to be able to apply the doctrine of equivalents to a term of a claim that was added during prosecution, the term cannot have been added to avoid the prior art. Patentees must provide reasons for the amendment as, absent such reasons, competitors are entitled to assume that the term was added to avoid prior art, or for some other reason related to patentability.

A less obvious limitation that this case imposes on the doctrine of equivalents arises from its emphasis on the elements of the claim. The doctrine must be applied to the elements of the claimed invention and not to the invention as a whole. Thus, an infringement must include equivalents of each of the elements recited in the claim. As a result, an alleged infringement that is recognized as like the claimed invention in relevant ways by those having relevant skill may nonetheless not infringe the patent where the alleged infringement does not include equivalents of all of the elements of any of the claims of the patent.

This limitation on the doctrine of equivalents is akin to the limitation imposed by file wrapper estoppel. Generally, elements are recited in a claim both to cover the invention and to avoid the prior art. If a single element can distinguish the invention from the prior art, then a single element should also suffice to distinguish an alleged infringement from the claimed invention. As a rule of thumb, the more elements listed in the claim, the less

164 Ibid
that claim will cover, as an equivalent of each element must be found in an infringement. Those reading the claim know this, and are entitled to assume that the patentee would not have included an element in a claim unless she thought that such element was required for the claim to be allowed.

This emphasis on the individual elements recited in the claims seems to be consistent with an externalist reading of the claim, given the context in which claims were written. Skilled readers of the claim will know that the elements of the claim are intended to both cover variants of the invention and to help to distinguish these variants from the prior art and inoperable subject matter. They will assume that the patentee would have left the element out if it were possible to do so. That the element was included, suggests that patentee considered the element to be required to provide a map enabling one to interact with others and the external world to implement the invention. If this element is not required, then this reveals a deficiency in the inventor's ability to interact with others and the external world to implement the invention.

Sometimes, the fact that it seems to be possible to take the invention without taking an equivalent of each element of any claim of the patent should not be taken to reflect a deficiency in the inventor’s ability to interact with others and the external world to implement the invention. Specifically, it may be impossible to find a necessary way of breaking down an invention into elements such that everyone who tries to implement the invention must take at least an equivalent of each element of the claims.

Recall claim 1 of the Walker patent considered in *Haliburton Oil*:

“1. In an apparatus for determining the location of an obstruction in a well having therein a string of assembled tubing sections interconnected with each other by coupling collars, means communicating with said well for creating a pressure impulse in said well, echo-receiving means including a pressure responsive device exposed to said well for receiving pressure impulses from the well and for measuring the lapse of time between the creation of the impulse and the arrival at said receiving means of the echo from said obstruction, and means associated with said pressure responsive device for tuning said receiving means to the frequency of echoes from the tubing collars of said tubing sections to clearly distinguish the echoes from said couplings from each other [emphasis added]”\(^{145}\)

\(^{145}\) *Ibid* at 178.
Despite Walker's functional limitation, written in italics in the above quote, being too broad to satisfy Justice Black, it may in fact be too narrow to protect his invention. Say that instead of using an amplifier, the defendant had changed the coupling collars so that they returned much stronger echoes that did not require amplification. Claim 1 would not have been infringed by such a device as it would not have included the amplification means, which was the only element recited in the claims that was not found in the prior art. Yet this device would seem to take much of Walker's invention. If experts were to look at the Walker device and the proposed device, they might well see the devices as the same. Yet if these experts are to consider each element of the claims in turn, then they may be unable to see the proposed device as like the claimed device as they could not see the proposed device as including equivalents for each element recited in the claim.

This variant of Walker's invention, assuming it is at all practical, is probably inferior to the variants Walker discloses. Thus, the fact that his claims do not extend to this variant of the invention, does not reflect a deficiency in his ability to interact with others and the external world to implement the invention. Thus, the Supreme Court's focus on the individual elements of the claim must, in some situations, give way to its recognition that different linguistic frameworks will be applicable in different situations. As language is only a part of forms of life, and forms of life differ, then the way that language is used in different forms of life will also differ. Thus, different linguistic frameworks will have to be used where different forms of life are implicated. With respect to some inventions and the technological forms of life from which they arise, it may be inappropriate to rigidly apply the doctrine of equivalents on an element-by-element basis.
CHAPTER TEN: PURPOSE CONSTRUCTION OF PATENT CLAIMS

Patent law in Canada and the United Kingdom is similar to patent law in the United States. There are, however, important differences. One difference is that in Canada and the United Kingdom the prosecution history of a patent is generally inadmissible when the claims of the patent are being construed, although the prosecution history may be admissible on other grounds, such as when it is alleged that the patent office has been misled in some way. Another difference is that in recent years, Canada and the United Kingdom have moved from their former approach to claim construction, which resembled the doctrine of equivalents, to a new approach to claim construction, which borrows from the doctrine of purposive construction of statutes.

Prior to the move to purposive construction, courts in Canada and the United Kingdom applied a two-step test for determining questions of infringement. The first step involved determining whether there is literal infringement. A claim is literally infringed if all of the elements recited in the claim are found in the alleged infringement. If there is literal infringement, then infringement is made out – there is no doctrine of reverse equivalents in Canada. If there is no literal infringement, then the courts consider whether there is infringement in substance.

In Marconi v. British Radio Telegraph and Telephone Company Ltd. Justice Parker provides the classic statement of infringement in substance:

“It is a well-known rule of patent law that no one who borrows the substance of a patented invention can escape the consequences of infringement by making immaterial variations. From this point of view, the question is whether the infringing apparatus is substantially the same as the apparatus said to have been infringed.”

The words "substantially the same" echo through the British and Canadian cases. The question of whether something is substantially the same as the invention depends on whether all of the essential elements of the claim are present. Thus, the claims are considered on an element-by-element basis, although some of the elements may be considered inessential. Accordingly different conclusions on the issue of infringement in substance can be arrived at for different claims that recite different elements.

146 (1911), 28 R.P.C. 181 (Ch. Div.)
147 Ibid at 217
First the House of Lords, and subsequently the Federal Court of Appeal in Canada have rejected this two-step test. In this chapter, the Canadian case that imported the doctrine of purposive construction from the United Kingdom is considered.

10.1: O'Hara Manufacturing Ltd. v. Eli Lilly & Co.\textsuperscript{148}

This case involved a patent covering an apparatus for applying a coating to tablets. At trial, the Court found the claims to be valid and infringed. The defendant appealed this decision to the Federal Court of Appeal.

In its judgment, the Court of Appeal describes the apparatus as resembling a front-loading clothes dryer. Similar to clothes dryers, the patented apparatus includes a rotary cylindrical perforated drum that is open at one of its ends. The drum is mounted for rotation about a horizontal axis of rotation. In operation, tablets are introduced to the drum via its open end. Then, coating material is poured over the tablets. Concurrently, the drum rotates and air flows through the drum and into an exhaust inlet that is against the outside of the drum. The rotation of the drum introduces a tumbling movement to the tablets. The airflow passes through the tumbling tablets, thereby drying the coating on the tablets.

The trial court found claims 1, 3 and 6 to be infringed. Claim 6 depends from claim 3.\textsuperscript{149} Thus, if claim 6 is infringed, claim 3 must also be infringed. Claim 1 covers a process for coating tablets, while claim 3 covers an apparatus for coating tablets. These claims include analogous limitations, so that only one of them needs to be considered here. Claim 3 reads as follows:

"A tablet coating apparatus comprising
   a rotary tumbling drum having a horizontal axis of rotation,
   said drum having a flat foraminous\textsuperscript{150} peripheral surface
   substantially concentric with said axis and imperforate side wall
   portions contiguous to said peripheral surface,
   means for rotating said drum at a speed to effect tumbling of a
   charge of tablets in a bed of substantially uniform depth in a

\textsuperscript{148} (1989) 26 C.P.R. (3d) 1 (F.C.A). The doctrine of purposive construction has yet to be applied in a significant way by the Supreme Court of Canada. However, in Camco Inc. et al. v. Whirlpool Corp. et. al. (1999) 9 C.P.R. (4th) 129 at 148, Justice Binnie for the Supreme Court of Canada held that the Federal Court of Appeal was correct in applying the purposive construction test in Eli Lilly & Co.

\textsuperscript{149} A dependent claim depends from the prior claims whose limitations it incorporates by reference.

\textsuperscript{150} Porous.
given sector in the lower leading quadrant of said drum with the
lowermost layer of said tablets in contact with a given area of
said drum's foraminous peripheral surface,
said drum having an interior space above said bed of tumbling
tablets through which a coating material is downwardly applied
on said tumbling tablets,
*an exhaust inlet flexibly biased against the exterior of said
drum’s flat peripheral surface* at said given sector and over an
area less than and centrally located relative to said bed of
tumbling tablets, the area of said foraminous peripheral surface
other than said sector providing an area greatly exceeding the
area of said exhaust inlet,
pressure differential means effecting a continuous velocity flow
of a large quantity of air from said foraminous peripheral area
other than said sector downwardly through said tumbling bed to
said exhaust inlet for driving said coating material downwardly
into the tumbling bed of tablets and forcing the particles and dust
from fragmented tablets at said given sector through the
foraminous eriphery of the drum and into the exhaust inlet
[emphasis added].”

The defendant's devices did not include the italicized element of the above claim — viz. the "exhaust inlet flexibly biased against the exterior of said drum's flat peripheral surface." Instead of being flexibly mounted and biased against the drum, the device was carefully engineered within very fine tolerances to allow the exhaust inlet to be mounted very close to the drum without being biased against the drum. At trial, the court found that what was essential "was that the exhaust inlet be mounted in such a way that by its close proximity to the lower leading quadrant of the drum it could accommodate the out-of-roundness of the latter with a minimum amount of air loss between the plenum and the drum." Accordingly, the claims were infringed as the substance of the invention had been taken.

With respect to the trial decision, the Court of Appeal concludes that the
decision of the trial judge is but an application of the traditional
type expressed in many decisions, here and in other
jurisdictions, following which a defendant may infringe an
inventor's monopoly either by doing something that infringes the
text of the claims or by taking the substance or pith and marrow
of the invention defined in those claims. According to that
type, a court, in deciding whether there is infringement, must
first interpret the claims and determine whether there is textual

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151 *O’Hara Manufacturing, supra,* note 148 at 4.
152 *Ibid* at 5.
infringement and, if it does not find textual infringement, it must engage in the difficult process of distilling the claims and extracting the substance of the invention so as to determine whether the defendants did steal it.\textsuperscript{153}

In rejecting this test, the Court of Appeal quoted from Lord Diplock of the House of Lords as follows:

"My Lords, in their closely reasoned written cases in this House and in the oral argument, both parties to this appeal have tended to treat ‘textual infringement’ and infringement of the ‘pith and marrow’ of an invention as if they were separate causes of action, the existence of the former to be determined as a matter of construction only and of the latter upon some broader principle of colourable evasion. There is, in my view, no such dichotomy; there is but a single cause of action and to treat it otherwise, particularly in cases like that which is the subject of the present appeal, is liable to lead to confusion."\textsuperscript{154}

Instead of the two-step approach to construction, a patent specification should be given a purposive construction rather than a purely literal one derived from applying to it the kind of meticulous verbal analysis in which lawyers are too often tempted by their training to indulge. The question in each case is: whether persons with practical knowledge and experience of the kind of work in which the invention was intended to be used, would understand that strict compliance with a particular descriptive word or phrase appearing in a claim was intended by the patentee to be an essential element of the invention so that any variant would fall outside the monopoly, even though it could have no material effect upon the way the invention worked."\textsuperscript{155}

This question is to be answered in the negative only

"when it would be apparent to any reader skilled in the art that a particular descriptive word or phrase used in a claim cannot have been intended by a patentee, who was also skilled in the art, to exclude minor variants which, to the knowledge of both him and the readers to whom the patent was addressed, could have no material effect upon the way in which the invention worked."\textsuperscript{156}

In \textit{Eli Lilly & Co.}, the Court of Appeal concluded that the

\textsuperscript{153} Ibid.
\textsuperscript{155} Ibid.
\textsuperscript{156} Ibid at 7, quoting from \textit{Catnic, supra}, note 154 at 243.
"claims clearly require that the machine comprises an exhaust inlet flexibly biased against the exterior of the drum; they cannot otherwise be interpreted. Moreover, it is not clear whether the inventor realized, when he made his invention, that this requirement was not necessary and that the machine would work as well if the exhaust was placed in a fixed position. It is not clear, therefore, that the inventor did not consider that requirement an essential element of the invention."\(^\text{157}\)

Similar to the doctrine of equivalents, the doctrine of purposive construction requires that the alleged infringement work in the materially the same way as the claimed invention. However, it differs from doctrine of equivalents in also requiring that it be clear to a skilled reader of the claim that the patentee did not intend the claim to exclude the variant from coverage. In this case, a lot of unnecessary detail was included in the claim despite the fact that it was known that these details might limit the eventual scope of the patent. This led the court to conclude that it was not clear that the patentee did not intend the claim to exclude the variant from the coverage of the claim. Similarly, where an element is added to a dependent claim and provides the sole basis on which what is covered by the narrow claim can be distinguished from what is covered by the broader claims, a Court might conclude that the patentee did not intend the element to prevent the narrow claim from extending to subject matter covered by the broad claim.

In its rejection of the traditional two-step approach to infringement, the Court of Appeal characterizes the second step of this test as "distilling the claims and extracting the substance of the invention so as to determine whether the defendants did steal it."\(^\text{158}\) This characterization suggests that the traditional two-step approach was based on a mentalist view of the invention in which there is some pure substance or essence of the invention that can be discerned from the claims. Once this substance has been grasped, it enables one to identify all embodiments of the claimed invention. Whether or not this portrayal of the traditional two-step approach is accurate or just, the fact that the Court is rejecting this approach suggests that the Court may see problems with this mentalist view of the language of the claims and the invention.

In fact, the test that the Court adopts is explicitly externalist. The first question to be answered is whether the alleged infringement works in materially the same way as the

\(^{157}\) \textit{Ibid.}\n
\(^{158}\)
invention. This question is answered through interaction with the world. Thus, the meaning of the claims depends on interaction with the world. Beyond this first step however, the emphasis is on the role that the claim will play in a form of life. Specifically, the relevant question is what would a skilled reader understand the patentee to have intended. No reference is made to a substance or essence of the invention. Instead the emphasis is on how the claims will be used.

\textsuperscript{158} Ibid at 5.
CHAPTER ELEVEN: CONCLUSION

Patent law aims to facilitate technological development by encouraging inventors to publicly disclose their inventions by obtaining patents for their inventions. For inventors to have the incentive to obtain patents and thereby disclose their inventions, the right to exclude others from using the invention must be valuable. For this right to be valuable, patents must be able to provide protection for inventions that cannot be avoided by making slight modifications to the invention. At the same time, patents will impede competition and technological development if they cover more than was invented. Thus, the construction of patent claims is critical to the aims of patent law.

In the cases considered, the United States Supreme Court has often brought a mentalist view of language to its task of construing the claims of a patent. In these cases, it has found for the defendant, either on the basis that the claims were invalid, or on the basis that they were not infringed. To determine whether this approach is consistent with the aims of patent law, consider how inventors or potential patentees would have acted if they had been advised of this approach to claim construction before they had filed a patent application. Would Evans, Haliburton Oil Well Cementing Company and Electric Signal Company have filed patent applications for their Hopperboy, oil well measuring device and railroad signaling apparatus respectively, if they had known that any patent protection they succeeded in obtaining would be limited to the specific mechanisms they disclosed? In all of these cases, steps could have been taken to keep these inventions secret.

By way of example, consider the Walker invention owned by Haliburton Oil Well Cementing Company. The Walker invention for measuring the depths of oil wells cannot be adequately protected if the invention is limited to specific mechanisms that Walker has in mind. Walker may not even have a single such mechanism in mind as the invention may depend on the expertise of others in, for example, amplifying echoes of a certain frequency received from tubing collars. This in no way affects Walker's ability to implement his invention provided he is able to interact with others who do have the relevant skill. If claims are construed such that Walker will be denied effective patent protection, then, if he is well advised, Walker will refrain from seeking patent protection and will instead try to keep his invention a secret. For similar reasons, Evans and Electric Signal Company would probably try to keep their inventions secret as well.
Fortunately for the patent system, the decisions of the courts are sufficiently inconsistent that such inventors are unlikely to obtain clear advice to refrain from filing patent applications and to try and keep their inventions secret instead. However, if only to bring some clarity to the law of claim construction, claims should be construed in a manner that is capable of affording adequate protection to all patentable inventions.

Based on the vastly different approaches they take, it seems likely that Wittgenstein and Putnam would strongly disagree on many questions of language use. However, they agree that knowing the meaning of words requires interaction with others and with the external world, and that the full range of application of a word cannot simply be known by someone who hears the word, without interacting with others or the external world. Many of Wittgenstein’s observations seem to apply to the language of patent claims, suggesting that patent claims should be read as providing a map for interacting with others and the external world and not simply as expressing a picture of the invention that wholly subsists in the inventor’s mind.

If claims were consistently read from this perspective, then even if they were properly advised as to the law, Evans, Haliburton Oil Well Cementing Company and Electric Signal Company would probably have sought patent protection for their inventions. Indeed, all of the inventions described in this thesis can be understood as involving interaction with others and the external world. Contrariwise, many if not all of the inventions described in this thesis cannot be understood as determined solely by a concept or picture of the invention that mirrors the operation of the invention in the external world.

Not only the facts, but also the law can be better explained from an externalist perspective. From a mentalist view of language, judicially developed rules of claim construction such as the doctrine of equivalents and purposive construction conflict with the requirement that the language of the claims define the inventions. If language provides a correlate picture of the world, then it is possible for inventors to capture all variants of an invention using the claims, and it is unjust to the public to permit inventors to encroach on any territory that is not represented in this correlate picture. In contrast, from an externalist perspective, some version of these rules is necessary to recognize
the ways in which the meaning of the claims depends on what skilled people would understand when they interact with the world in the way stipulated by the claim.

The facts and decisions in *Graver Tank*, *Warner-Jenkinson*, and *O'Hara Manufacturing* may seem to challenge the applicability of an externalist view of claim language in that they restrict the extent to which the agreement in judgment in the form of life of the invention can influence the construction of the claims. However, I think that the better view is that these cases reflect the fact that the forms of life that gave rise to patent claim language games are not limited to expressing the agreement in judgment in fields of technology. Instead, these forms of life include considerations of patent law. One of these considerations is that applicants will not include elements in claims, thereby potentially limiting the scope of the claim, unless they think that these elements are somehow important to the validity of the claim. This is particularly true of elements that are added to overcome prior art objections during prosecution of the patent application, and of elements that are added to distinguish narrower claims from broader claims. There may be agreement in judgment among those skilled in the art of coating tablets that an exhaust inlet flexibly biased against the exterior of a drum is the same as an exhaust inlet mounted within very fine tolerances to be very close to a drum without being biased against the drum. However, this agreement in judgment may be lost when the skilled reader takes into account the fact that those drafting the claim would have known that the claim might well be limited to machines in which the exhaust inlet is flexibly biased against the exterior of the drum. That is, a reader of a claim must also take into account the strategic reasons for including elements in claims. Unlike a mentalist view, which can accommodate neither the doctrine of equivalents nor purposive construction, an externalist view of claim language can accommodate both of these doctrines, as well as limitations on their application.

This was the second and narrower aim of the thesis – to show that an externalist reading of claims is required to adequately protect inventions. The first and the broader aim of the thesis was to show that philosophical insights into language use and scientific knowledge can be used to illuminate the role that the language of the claims plays in the field of the invention. This illumination is not limited to showing that an externalist reading of claims is required to adequately protect inventions.
Recall that in *Winans*, the Supreme Court applied the doctrine of equivalents to extend the claims to the alleged infringement, while in *Dryfoos* the Court declined to do so. Bringing an externalist view of language to a comparison of these cases draws out aspects that might otherwise go unnoticed. These aspects relate to the forms of life in which each of the inventions arose. In *Winans*, the language of the claims evoked a well-developed paradigm that was able to direct those having suitable skill to other variants of the invention. Put another way, there was considerable agreement in judgment in the form of life of the Winans invention, which had the effect of extending the extent of the invention. In contrast, there was little agreement in judgment in the form of life of the invention considered in *Dryfoos*, which had the effect of limiting the extent of the invention. Courts have long known that patent cases must be judged from the perspective of those having relevant skill. This comparison of *Winans* and *Dryfoos* shows why the judgment of those having relevant skill is partially determinative of the extent of the invention.

Recall the holding of the Supreme Court in *Machine Co.*:

"argument to show that the form of the knife and the cutter are substantially the same is quite unnecessary, as that is proved through a demonstration by a comparison of the two edges.... Except where the form is of the essence of the invention, it has but little weight in the decision of such an issue, the correct rule being that, in determining the question of infringement, the court or jury, as the case may be, are not to judge about similarities or differences by the names of things, but are to look at the machine or their several devices or elements in the light of what they do, or what office or function they perform, and how they perform it."  

This judgment’s focus on actual machines and elements, rather than on the names of things, seems to reflect an externalist view of the invention. Yet something is lost when we can no longer use language and argument to help to determine how things are alike or different. This seems to render language useless in guiding inquiry into the extent of an invention. Yet as the below example illustrates, when seen from an externalist standpoint, language is far from useless in this respect although it does play a different role than it does from a mentalist standpoint.

159 *O’Hara Manufacturing Ltd.*, supra, note 48 at 4 and 5.
It is not uncommon that after the claims of a patent application have been written and the application filed that the inventor calls her patent agent and describes a completely new embodiment of the invention. When this happens, it raises serious issues as if this embodiment is not covered by the claims of the filed application, then a new application should probably be filed. Often, however, a new application is not needed as the claims of the existing application already cover the new embodiment of the invention.

From a mentalist view of language and technology, it is easy to explain this phenomenon. It appears that the patent agent has correctly broken down the invention into essential elements. The names of these essential elements evoke corresponding concepts in the minds of readers of the claims. These concepts underlie the meaning of our words and the operation of our technology. Like laws of nature they are constitutive of a correlate picture of our world. As the concepts evoked by the claims underlie the operation of our technology, they underlie the operation of every variant of the invention. Thus, even if the inventor or competitors come up with completely new variants of the invention, the claims will apply to these variants.

If the mentalist view of claim language and inventions is wrong, then it seems to become more difficult to explain the experience of a claim extending to cover a previously unknown embodiment of an invention. To give up the mentalist view of language seems to entail giving up the view that one can get to the heart of things, and this despite past experiences of seeming to have got to the heart of things. Yet both the impression that it is possible to get to the heart of things using language, and that insight is lost when the mentalist view of language is discarded, are mistaken.

To have the language available that is required to seemingly define the essence of the invention, there must be agreement in judgment in the form of life that gave rise to the invention. The language used in the claim is expressive of this agreement and will reflect the experience of those in the linguistic community who have interacted with the world in respects that are relevant to the invention. The inventor and patent agent have available to them the language that reflects this experience. However, much of this experience will not be their experience. When the inventor comes up with new variants

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160 *Machine Co.*, *supra*, note 59 at 124 to 125.
of the invention, these variants are new to the inventor and the patent agent. However, these variants echo the experience of others about what things are alike and what things are not alike. This experience of others went into forming the agreement in judgment that supports the language used to define the invention in the claim, thereby allowing the claim to extend to the new variants. A language is a repository of the experience of the people who speak it, such that members of that people draw upon the experience of others when they use the language. In using language that is based upon agreement in judgment in the field of the invention to draft a patent claim, a patent agent draws upon the experience of others about what is like or unlike the elements of the invention. Thus, the fact that language is available with which to define the invention reflects the agreement in judgment in the form of life of the invention that provides the extent of the invention.

The utility of language as a proxy for indicating the agreement in forms of life also suggests why the Courts tend to penalize patentees who do not make a serious effort to express this agreement in the claims. In Rowell and General Electric Co., little effort was made to define the invention in the claims. This was probably due to different reasons in each case. In Rowell, there does not appear to have been any reason. In General Electric Co., however, the inventor Pacz was probably afraid that the features that he had identified as critical to the invention were not in fact critical to the invention, and that subsequent research by others would reveal this to be the case. Accordingly, the inventor was unwilling to include this limitation in the claims.

The extent of an invention is determined by the degree of agreement in the form of life of the invention. This need not be the agreement at the time the patent application was filed. If Pacz had recited in his claims the limitation that the grains of the tungsten filament have either irregular boundaries or regular boundaries that are not perpendicular to the longitudinal axis of the filament, then he would have been trying to anticipate eventual agreement. A patent applicant is obliged by statute to give some indication of the extent of the invention. By failing to write claims that were expressive of agreement in the form of life of their inventions, Rowell and Pacz failed to meet their statutory obligation to indicate the extent of their inventions.
When patent agents draft the claims that define an invention, the elements they recite in the claims provide the players for the patent claim language game. If they are successful, then the claims they draft will express the agreement in judgment, whether at present or in the future when knowledge of the invention is disseminated, regarding how to proceed to implement the invention. However, patent agents can never provide more protection for an invention than that which is made possible by the agreement in judgment in the form of life of the invention about what is like the elements of the invention. That is, they can never get to the heart of the invention, but only to the heart of the agreement in judgment in the form of life of the invention.