Structured Patent Development

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Abstract

Effective patent protection for inventions is critical to businesses in today's rapidly developing technology marketplace. When I ask patent attorneys what one thing inventors could do to help them write strong patents, they often say that a concise and focused description of the invention would help tremendously. The language of the inventor and the patent attorney are different and difficulty bridging this gap can result in weak patent protection, delays and high cost. This article describes a method for inventors to provide information to their patent attorney that will make it easy and quick for the patent attorney to write a strong patent. The method uses function models to describe how and why the invention works. The function model is then used to simplify the invention to find it's broadest description. Then TRIZ (Russian acronym for Theory of Inventive Problem Solving) inventive principles are used to expand the invention. The final result is a Structured Description of the invention that provides the patent attorney with a concise definition of the invention from which he/she can write a strong patent.

Introduction

If necessity is the mother of invention, then the patent attorney or agent (patent attorney for simplicity) may well be the father. So where does the inventor fit into this scheme. There is more than a little anecdotal evidence of inventors handing the patent attorney a simple sketch or an idea on the back of a napkin and letting him or her fully develop the patent application. Sometimes the inventor is a PhD student and he provides the patent attorney a 100 page thesis on the invention. In the first instance the patent attorney can't afford to take the time to research all of the implications of the invention from a simple description. In the second instance the patent attorney can't afford the time required to read a lengthy document and glean the essence of the invention.

When an inventor is working on a problem, he or she usually stops when an apparent solution is found. The inventor provides a description of the invention to the patent attorney. At that point the patent attorney and the inventor will research the relevant literature and issued patents or published applications to create a background and detailed description for the patent application. This places a burden on the knowledge and skill of the patent attorney to fully explain and expand the invention as well as prepare proper claims with the patent office rules. In some situations this may work well where the patent attorney has the appropriate technical background, such as a Ph.D. in science or engineering, provided he or she stays current in that field and is experienced in both patent prosecution and litigation. Even then the process is relatively slow, time consuming, expensive, and there is potential for a less than satisfactory result.

At the other end of the spectrum is the inventor who files a patent application, usually a provisional application, in a paragraph or two without a clear understanding of the nuances in patent law and practice. New data can be introduced from provisional application to utility application but new ideas cannot be introduced once the provisional is filed. The problem with this approach is that even with an inventor who has experience with the patent process, he or she may not be able to prepare an application that demonstrates the invention as useful, novel, and not obvious. Although most ideas can meet the requirement for usefulness, many run into trouble because other descriptions in the literature or other patents are so similar that the idea is deemed not to be novel. Along this same line, it may be determined that prior art anticipated the current invention, and it would be obvious to one skilled in the art. Lack of understanding may cause the application to languish in the patent office for many years.

There are also many words that can trap an inventor into narrow claims when drafting an application. These may be difficult or impossible to overcome when a patent attorney begins to develop a non-provisional utility application or a Patent Cooperation Treaty (PCT) application. As can be imagined, use of the words “only”, “must”, “cannot”, “will not”, or “requires” will severely limit the breadth of the claims. The use of patent jargon, such as “teaches” or “best mode” gleaned from issued patents should be avoided as these have specific meaning within the courts and patent office. In the academic world, where many provisional applications are prepared, there is a tendency to write the application as if it is an academic paper. The danger in this approach is that the application will almost always be very narrow and may include future plans of the research that can bring into question whether the idea has reached the level of an invention.

It is axiomatic that the patent application should be written to allow for the greatest claims coverage for the invention without conflicting with prior art. This requires dancing on the balance beam by both the inventor and the patent attorney. If the inventor writes an application to address a specific problem, he or she may receive narrow claims having limited or no commercial value. In fact, the inventor may not be able to use the invention at all if another patent exists with more general claims. On the other hand, the application may be written so generally as to be vague and unable to support the claims, or prior art may preclude the issuance of a patent.

In addition to the differing approaches to the patent process, the inventor (or his/her employer) must determine that the invention is economically valuable and that use of the invention by others can be easily detected. Then the inventor may wish to seek patent protection. The patent attorney wants to write the patent claims as broadly as possible as they have greater commercial value because the generality of the language in a broad patent claim covers a lot of turf. Narrow or specific patent claims are usually easier to write and to read, but they limit the protection to only the specifics of the claims. The information provided to the patent attorney about the invention is usually very specific to the precise invention. Working with the patent attorney, the scope of the invention will be expanded as much as possible. Broadening the claims of the patent is both a technical and a legal activity. Patent attorneys understand the legal aspects of broadening the claims while Inventors are often not as comfortable broadening the technical aspects of the claims. As a result, inventors often improperly rely too much on the technical background of the patent attorney to broaden the technical scope of the invention.

The best solution for this problem results when the inventor can effectively communicate all of the information the patent attorney requires to write broad and effective claims. This article will provide a structured method for expanding the information to the patent attorney in the form of “a ”. To explain how to construct a broad and effective Structured Description, I will use a hypothetical invention, a method for making a ham sandwich, as an example[1].

An Illustrative Example

Imagine that no one has invented the ham sandwich and you have just come up with the idea in your kitchen. You clearly understand how to make the sandwich and can write down step-by-step instructions. Your family enjoys your ham sandwiches so much that you believe you can

[1] This example was used by Phil Emma of IBM in an article in the November-December 2005 issue of IEEE Micro.

sell the invention to restaurants and food companies. You decide to apply for patent coverage to protect your invention.

Modeling the Invention

The process flow diagram in Figure 1 below describes our invention. First, we retrieve two slices of bread from the pantry and get the ham and mayonnaise from the refrigerator. We are now ready to put the ham on one slice of bread and put mayonnaise on the second slice of bread. Final assembly of the sandwich is completed by lifting the second slice of bread, turning it over and placing it on top of the ham and first slice of bread.

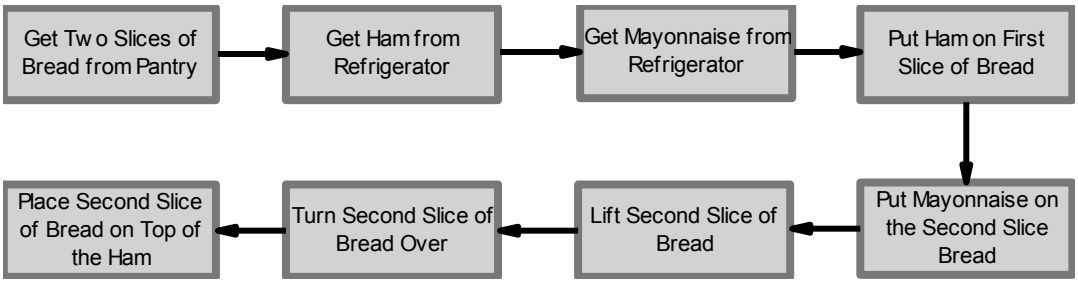

Figure 1: Process Flow Diagram

A simple written description or diagram is often given to the patent attorney for the purpose of writing a patent to protect the invention. Our ham sandwich invention is clearly useful. It is not unobvious or novel as everyone knows how to make a ham sandwich. However, for purposes of this example, we have assumed that no one ever thought of a ham sandwich. Now, our patent attorney may not know very much about ham sandwiches and because we are independent inventors without the benefit of in-house counsel, we are trying to keep our legal costs down. Our attorney might feel that he/she cannot put a lot of time into understanding our sandwich technology or reviewing prior art in great depth. The simple thing to do would be to write our patent claim as follows.

> A method for making a ham sandwich comprising placing a slice of ham on a first slice of bread, spreading mayonnaise on a second slice of bread, turning said second slice of bread and mayonnaise over by 180 degrees and placing said second slice of bread and mayonnaise on top of said first slice of bread and ham.

This claim is very narrow indeed. A competitor looking at this claim could easily find alternatives. Major steps in the method could be eliminated, circumventing our main claim. Or altering the order in which the method steps are performed could make the competitor's claim novel and potentially unobvious. As a result, we could lose millions in potential ham sandwich licensing revenue.

The first problem is that we started from a process flow diagram. A process flow diagram describes what we do first, second, third and so on. While there is a lot of useful information to be gleaned from a process flow diagram, it does not help us describe the cause-and-effect logic of the invention. Our patent claims need to describe "how" we make a ham sandwich. A process flow diagram is not particularly well suited for this purpose. Fortunately, there is a tool well suited for this purpose: function modeling.

Function models are used to deconstruct problems and reveal cause-effect relationships. In building function models we consider two types of functions: useful and harmful. Useful functions are shown in green and harmful functions are shown in red. The arrows connecting the functions describe their relationship. A solid arrow means that the first function produces the second function. An arrow with a cross hatch on the arrow means that the first function counteracts the second function. An arrangement of particular interest is contradiction. A contradiction exists when a useful function produces a useful result and also a harmful effect. We are interested in contradictions because the usual way to deal with a contradiction is to compromise between useful and harmful. However, if we can find a way to resolve a contradiction, this often leads to step change improvements in performance.

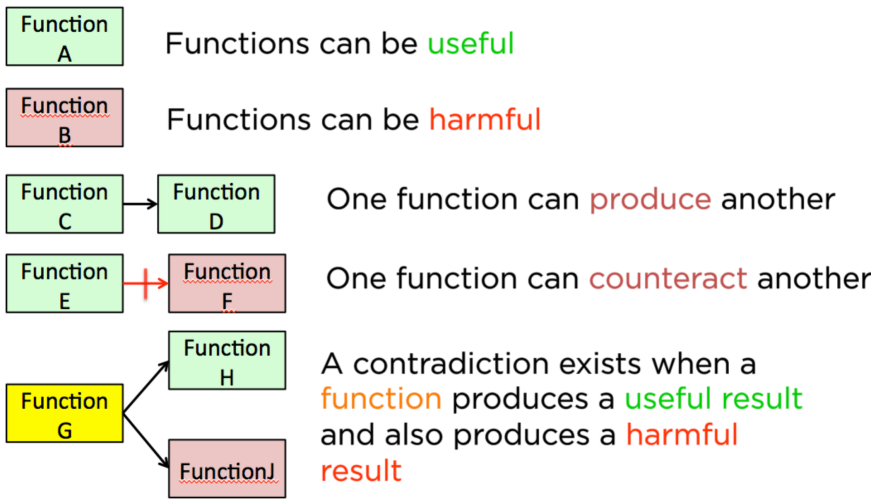

Figure 2: Function Models

The Specific Function Model

A function model of our method to produce a ham sandwich is shown in Figure 3. This model describes the major logic path that details the basics of how and why things are done in our method. It does not contain any information about consequential functions that result from execution of the functions in the major logic path. The model in Figure 3 is the Specific Function Model.

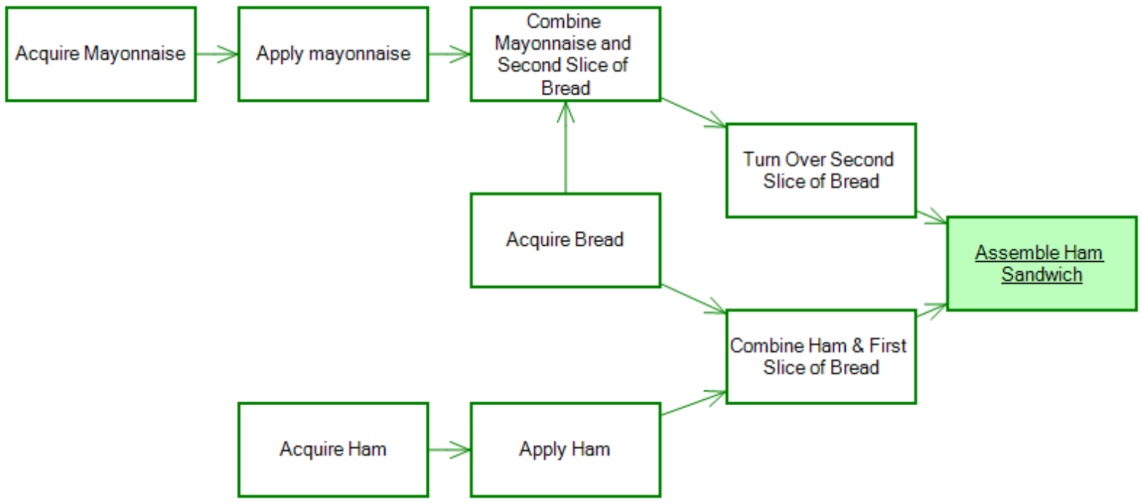

Figure 3: Specific Function Model for Producing a Ham Sandwich

Looking at the far right, we see the primary function of our method, “Assemble Ham Sandwich”. Notice that this is an action. In fact, every function in our model is an action. This is one of the rules of function modeling: A function is an action, activity or event. To begin the modeling process we look at the primary function and ask “how do we Assemble Ham Sandwich”? The answer is that we “Combine Ham and First Slice of Bread” and “Turn Over the Second Slice of Bread”. When we move in the opposite direction to the arrows in the major logic path, we ask “How”. When we move in the direction of the arrows in the major logic path, we ask “Why”. Asking “Why” provides verification that our logic is correct. Why do we “Combine Ham and Fist Slice of Bread”? So we can “Assemble Ham Sandwich”. Why do we “Turn Over the Second Slice of Bread”? So we can “Assemble Ham Sandwich”, and so on.

Generalizing the Invention - The Pure Function Model

The Specific Function Model of Figure 3 describes our ham sandwich method exactly as we created it. However, we would like our patent to be written as broadly as possible. We have already seen that writing a patent claim directly from the process flow diagram produces a very narrow patent claim. A similarly narrow claim would result from the Specific Function Model. To get breadth, we can generalize the Specific Function Model by removing the physicality from the model wherever possible. For example, a ham sandwich is a structure comprising ham, bread, mayonnaise and perhaps other components. Therefore, we can replace our primary function, “Assemble Ham Sandwich”, with a more generalized function, “Assemble Structure”. Bread and Ham are physical “components” which are employed to assemble the sandwich. Thus “Combine Ham and First Slice of Bread” becomes “Combine First and Second Component”. Continuing this process for each function in the Specific Function Model produces the Pure Function Model shown in Figure 4.

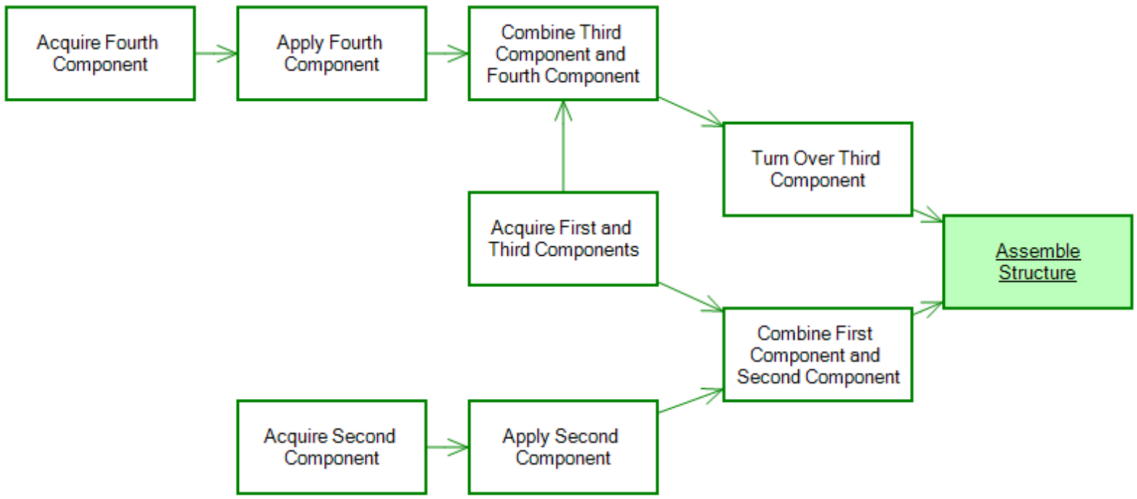

Figure 4: Pure Function Model

A patent claim based on the Pure Function Model might look like the following.

> A method for assembling a structure comprising a first component placed on a second component, placing a third component on a fourth component, turning said third and fourth components over by 180 degrees and placing said third and fourth components on top of said first and second components.

A corresponding apparatus claim might look like this.

> A structure comprising a first component on top of a second component, a third component on top of said first and second component and a fourth component on top of said first, second and third component.

If these claims were to be held valid, it would be very powerful indeed. A cup on a saucer on a place mat on a dining room table would infringe our apparatus claim. Such a broad claim is not likely to survive the patent examination process. Our patent application must have a claim structure that lies somewhere in between the claims derived from the Specific Function Model and the Pure Function Model.

Getting Outside Prior Art – The Base Patent Model

Figure 5 shows all of the functions in the Specific Function Model in the left column and all of the corresponding functions in the Pure Function Model in the right column.

Specific Function Model	Patent Base Model	Pure Function Model
Assemble Ham Sandwich		Assemble Structure
Combine Ham and First Slice of Bread		Combine First Component and Second Component
Apply Ham		Apply Second Component
Acquire Ham		Acquire Second Component
Acquire Bread		Acquire First Component
Turn Over Second Slice of Bread		Turn Over Third Component
Combine Mayonnaise and Second Slice of Bread		Combine Third and Fourth Component
Apply Mayonnaise		Apply Fourth Component
Acquire Mayonnaise		Acquire Fourth Component

Figure 5: Function Table

Remembering that the claims in our patent application must lie between the Specific Function Model and the Pure Function Model, we can examine each corresponding function in these two models and define a function that is as broad and inclusive as possible and also outside of the prior art. First, let's consider the primary function. Starting from the right side, we could limit the Structure to Food Structures. This would narrow the model considerably but we would still probably be covered by prior art. We could further limit the function to foods used to make sandwiches. In this case our primary function might be "Assemble Sandwich". Remember, we are assuming that the sandwich has not been invented yet and there is no reason to limit our

patent to ham sandwiches. Therefore, in Figure 6 we have entered “Assemble Sandwich” in the center column.

Now consider the next function in the list. The pure function model refers to Component (Combine First and Second Component). This function can be narrowed to include only Food Components. Our studies of prior art might indicate that this may still be too broad. We can further narrow the function to reference Protein Component and Carbohydrate Component. We have entered “Combine First Protein Component and First Carbohydrate Component” in the center column. This analysis is continued for each of the matching functions in the Specific Function Model and the Pure Function Model. The final result is shown in Figure 6.

Specific Function Model	Patent Base Model	Pure Function Model
Assemble Ham Sandwich	Assemble Sandwich	Assemble Structure
Combine Ham and First Slice of Bread	Combine First Carbohydrate Component and Protein Component	Combine First Component and Second Component
Apply Ham	Apply Protein Component	Apply Second Component
Acquire Ham	Acquire Protein Component	Acquire Second Component
Acquire Bread	Acquire Carbohydrate Component	Acquire First Component
Turn Over Second Slice of Bread	Turn Over Combined Second Carbohydrate Component and Condiment Component	Turn Over Third Component
Combine Mayonnaise and Second Slice of Bread	Combine Second Carbohydrate Component and Condiment Component	Combine Third and Fourth Component
Apply Mayonnaise	Apply Condiment Component	Apply Fourth Component
Acquire Mayonnaise	Acquire Condiment Component	Acquire Fourth Component

Figure 6: Function Table including functions outside prior art

Next we build an analogous model using the functions in the center column as shown in Figure 7. This is the Base Patent Model. The Base Patent Model describes the invention that is outside of prior art and is likely to meet the patent office requirement that inventions must be useful, novel and unobvious.

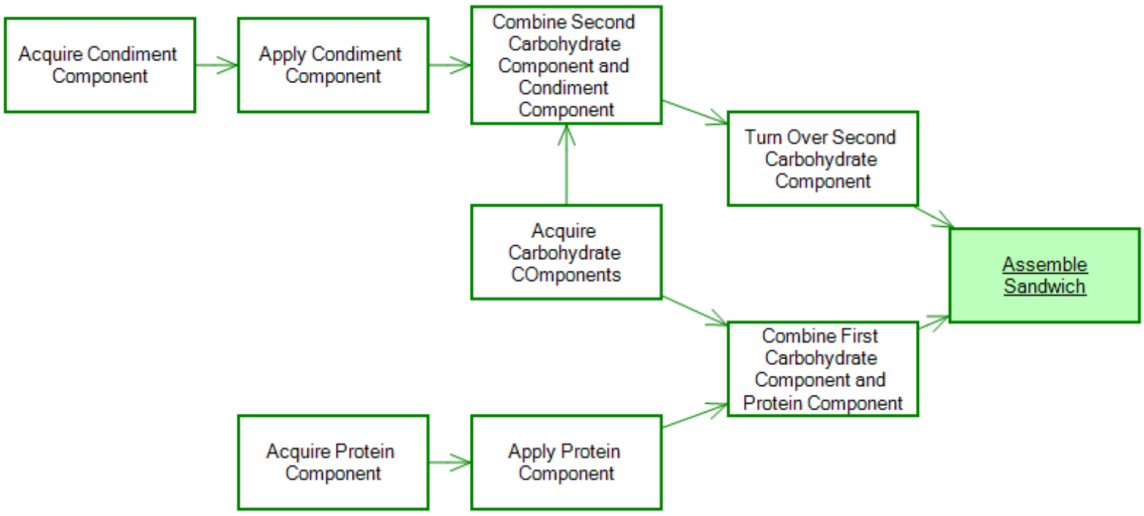

Figure 7: The Base Patent Model

Expanding the Invention – Improving Useful Functions

Our model of the invention is still pretty specific at this point. We would very much like to expand it to cover all of the possible variations for producing a sandwich. We can accomplish this in a very structured manner by expanding the Base Patent Model. One very useful characteristic of function models is there are only three approaches to improving performance as shown in Figure 8.

- Improve useful functions
- Reduce or eliminate a harmful functions
- Resolve contradictions.

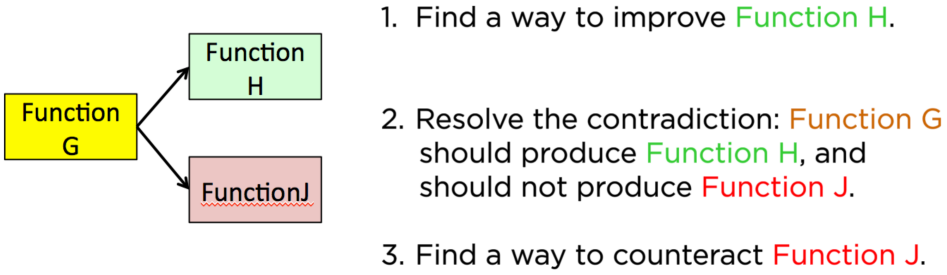

Figure 8: Function Models Provide Insight to Increased Functionality

At this point, our model only contains useful functions. We have not yet considered harmful functions that limit the performance of our invention. We can examine each function in the Base Patent Model and consider how to improve it.

It would be very beneficial to have a structured method to explore opportunities to improve and expand the functions in the Base Patent Model. TRIZ (Russian acronym for Theory of Inventive Problem Solving) offers an effective way to find opportunities to improve our model. Genrich Altshuller developed his TRIZ theories in 1946. At the time, Altshuller was a patent agent in the Soviet Navy and he saw a lot of patents, both foreign and domestic, come across his desk. He

began to question whether invention was the result of creative genius alone or was there a structure or method by which inventions were made? Altshuller studied thousands of patents looking for structure in the inventions. From his study of these patents he developed the concept of technical contradictions, the concept of ideality of a system, contradiction matrix, and 40 inventive principles. The inventive principles are themes or abstractions that occur over and over across a wide variety of inventions. Altshuller believed that these patterns could be the basis for an innovation algorithm.

In December 1948 Altshuller wrote a letter to Joseph Stalin addressed “Personally to Comrade Stalin.” He told Stalin that there was chaos and ignorance in the USSR’s approach to innovation and that he had discovered a theory that could make the Soviet people the most innovative people in the world. Altshuller was in fact a patriot but his actions were treated as treason. Two years after he wrote to Stalin, he was arrested and sentenced to 25 years in prison. He was transferred to Siberia’s Gulag where he worked as a logger and he also worked in the Varkuta coalmines. Throughout his incarceration, he continued to develop his TRIZ theories. A year and a half after Stalin’s death, amnesty was granted to many political prisoners and Altshuller was released.

Over his lifetime, Altshuller developed a number of innovation algorithms including ARIZ-71, ARIZ-77 and ARIZ-85. Virtually all of this work went unnoticed in the West because of the cold war. With the advent of Perestroika and the fall of the Soviet Union, Altshuller’s work became recognized throughout the world. In 1992 the leading TRIZ scientists in the world relocated to the United States. TRIZ now has over 50 years of research and development and has been used to solve thousands of inventive problems in a wide variety of disciplines. There is no consensus about the number of TRIZ inventive principles. Many people are very effective using the original 40 principles that Altshuller developed. Others have proposed that there are hundreds of inventive principles. For our purposes, I have examined TRIZ variations and selected a system of principles that can be used to systematically examine opportunities for improvement.

Figure 9 is a method for organizing the inventive principles from TRIZ into four groups: principles to resolve contradictions, principles to counteract harmful functions. principles to improve the performance of useful functions and principles to leverage resources..

Resolve a Contradiction by Using Separation Principles			
On Condition	In Structure	In Space	In Time
Dynamism	Partitioning	Another Dimension	Preliminary Action
Excessive Action	Integrate	Nesting	Parallel Processing
Partial Action	Mediator	Passing Through	Use Pauses
Restoration	Use a Model	Take Out a Part	Accelerate
Isolate	Controllability	Concentrate	Stretch Out
Counteract			Post-Process Time

Counteract a Harmful Function	
Eliminate the Cause	Exclude
Vaccination	Inversion
Isolate	Partitioning
Counteract	Integrate
Mismatch	Mediator
Restoration	Use a Model
Conversion	Controllability

Improve a Useful Function	
Intensify	Exclude
Disposable	Inversion
Universality	Partitioning
Specialization	Integrate
Dynamism	Mediator
Matching	Use a Model
Partial Action	Controllability
Excessive Action	

Mobilize Resources				
Space	Time	Energy/Forces	Substances	Information
Another Dimension	Preliminary Action	Dissipated	Raw Materials	Output Flows
Nesting	Parallel Processing	Flows	Waste	Passing Flows
Passing Through	Use Pauses	Environmental	Environmental	Detection
Take Out a Part	Accelerate	Transformed	Transformed	Additives
Concentrate	Stretch Out			
	Post-process Time			

Figure 9: System of Inventive Principles

Figure 10 shows the result of applying the system of TRIZ inventive principles to the Base Patent Model. All of the functions in this model are useful. Therefore, we use the inventive principles to brainstorm ways to improve each useful function. The table in Figure 10 lists each function in the Base Patent Model, ideas to expand each function, the TRIZ inventive principle that was used to generate each idea and the definition of the TRIZ inventive principle.

Figure 10: Brainstorming Functions in the Base Patent Model

Function Name	Principle Name	Principle Definition	Idea
Acquire First and Second Carbohydrate Component	Mobilize Resources – Substances – Raw Materials	Use raw materials as a resource to increase system Ideality.	1. Use crackers
			2. Use bread
			3. Use pitas
			4. Use tortillas
	Specialization	Replace a universal system with set of specialized systems.	5. Use specialty bread
Acquire Protein Component	Mobilize Resources – Substances – Raw Materials	Use raw materials as a resource to increase system Ideality.	6. Use ham
			7. Use turkey
			8. Use bologna
			9. Use roast beef
			10. Use cheese
Acquire Condiment Component	Mobilize Resources – Substances – Raw Materials	Use raw materials as a resource to increase system Ideality.	11. Use mayonnaise
			12. Use mustard
			13. Use BBQ Sauce
			14. Use vegetables such as lettuce, tomato, peppers, etc.
	Inversion	Think the opposite. Replace an action in the system with an opposite action.	15. Do not use any condiments
Apply Protein Component	Intensify	Intensify the function by concentrating resources.	16. Use thick slices of ham
Apply Condiment Component	Inversion	Think the opposite. Replace an action in the system with an opposite action.	17. Apply condiment (mayonnaise) to the ham
	Excessive Action	Provide excess then remove the remainder	18. Apply more than one layer of condiment (mayonnaise)
	Integrate	Consolidate two or more systems or functions for a synergistic effect	19. Combine condiments (mayonnaise with mustard, etc)
Prepare first carbohydrate component	Intensify	Intensify the function by concentrating resources.	20. Use more than one layer of carbohydrate component (bread)
Prepare second carbohydrate component	Exclude	Exclude auxiliary functions or elements by transferring them to remaining ones.	21. Use only one slice of carbohydrate component (open face sandwich)
	Matching	Match functions or structures within a system to improve performance	22. Use slices of protein component (ham) that are the same size as the carbohydrate component (bread slices)
Turn over second carbohydrate component	Inversion	Think the opposite. Replace an action in the system with an opposite action.	23. Turn over the first carbohydrate component and place it on top of the second carbohydrate
	Mobilize Resources – Time - Synchronization	Synchronize processes.	24. Combine first and second carbohydrate component at the same time
Assemble sandwich	Partitioning	Divide then recombine in a more efficient way. Replace a one piece system with a partitioned one.	25. Cut the sandwich into two or more pieces

A number of these ideas are derived from utilization of available material resources, such as using turkey (Idea 7) or using mustard (Idea 12), may seem obvious. Some ideas are less obvious due to psychological inertia. For example, we think of a sandwich as having two slices of bread but the “Exclude” principle suggests eliminating one slice to form an open face sandwich (Idea 21) and the “Intensify” principle suggests adding more slices of bread to form a triple-decker sandwich (Idea 20). The “Integrate” principle suggests combining condiments such as mayonnaise with mustard (Idea 19). The “Inversion” principle suggests using no condiments at all (Idea 15). A small team of subject matter experts skilled in application of these inventive principles can generate a nearly exhaustive set of expansion ideas.

Complete Patent Model

The ideas generated by application of the TRIZ inventive principles can now be added back into the Base Patent Model to produce the Complete Patent Model which is shown in Figure 11. This model is now outside of prior art and has been expanded to cover a broad range of variations of the basic invention.

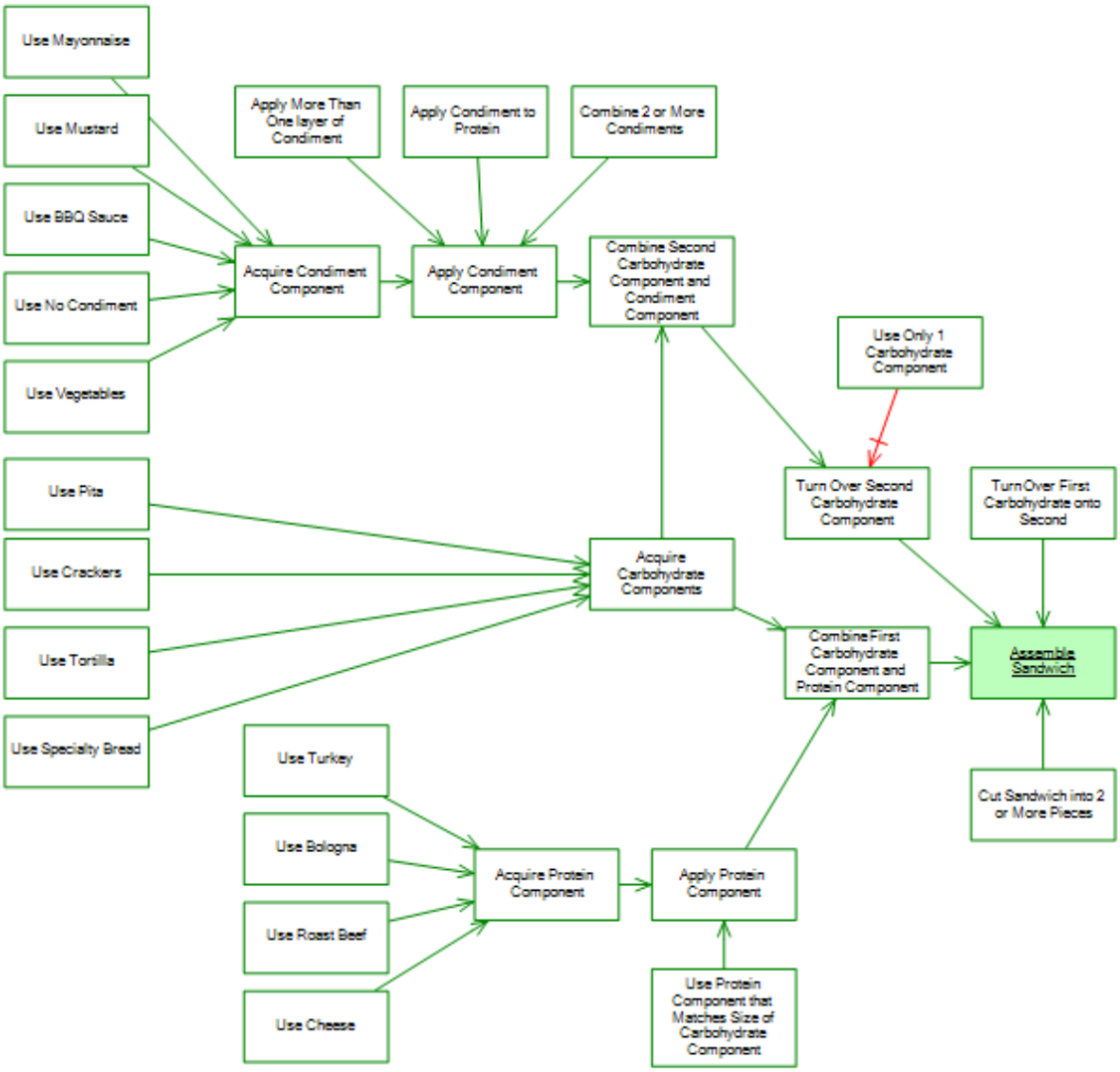

Figure 11: Complete Patent Model

Foundation Model

In preparing our Structured Description, we want the first item to be as broad as possible such that it covers as many variants of the invention as possible. Starting with the first item as the foundation, we can write dependent items to provide more and more specific detail. The Foundation Model can be derived starting from the Complete Patent Model. Figure 12 shows the Complete Patent Model previously developed for our ham sandwich invention. Remember that the primary function in this model is “Assemble Sandwich”. For each function in the Complete Patent Model we ask the following question. “If this function is eliminated, will the primary function still be minimally delivered?” If the answer is yes, the function being questioned is eliminated from the Complete Patent Model. The resulting model is the Foundation Model.

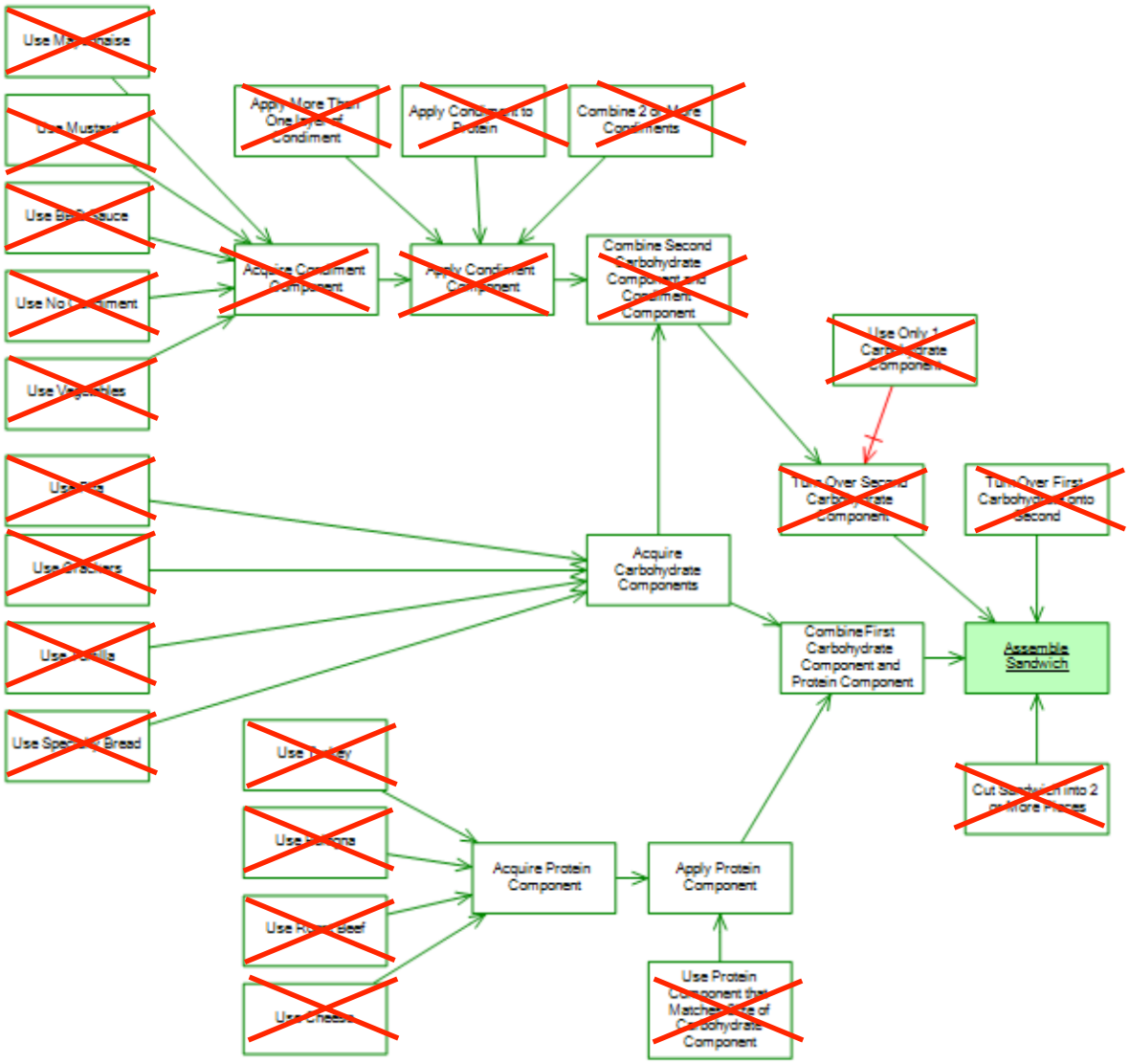

Figure 12: Development of the Foundation Model

The functions marked with a red X are eliminated to form the Foundation Model as shown in Figure 13. The Foundation Model describes the simplest method to deliver the functionality of our invention.

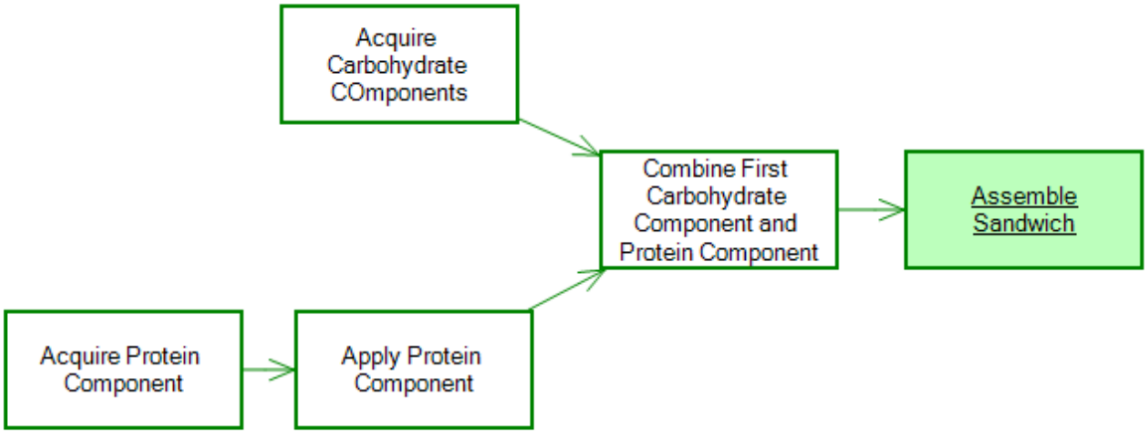

Figure 13: Foundation Model

Developing the Structured Description

We can now develop a Structured Description working from the Foundation Model backward to the Complete Patent Model. The Structured Description is developed from an analysis of the functionality delivered by the invention and will thoroughly cover the inventive space in a way that provides the broadest description. The first independent item is written directly from the Foundation Model. It is a simple declarative sentence starting from the primary function working backward.

1. A method for assembling a sandwich comprising the steps of placing a protein component on top of a first carbohydrate component.

The first dependent Item is developed by adding the previously deleted functions back into the Foundation Model.

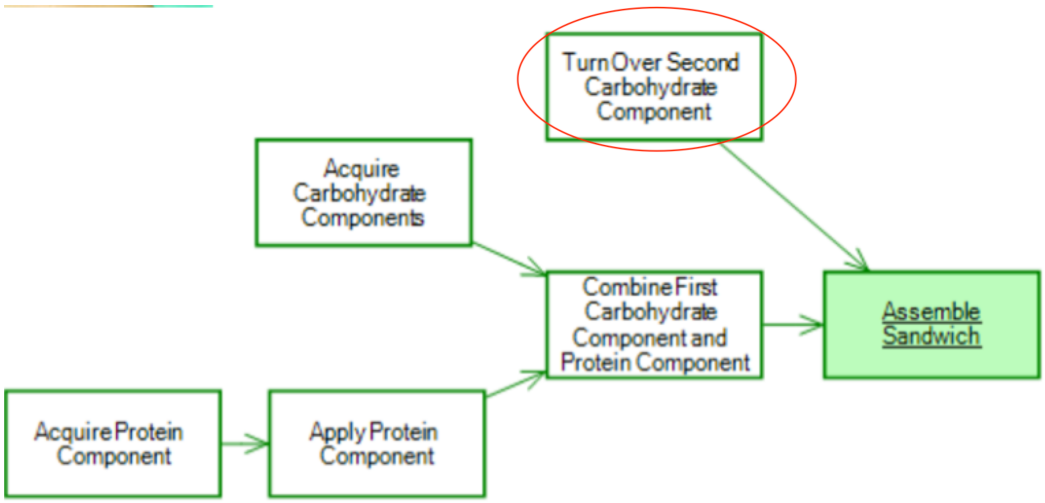

Figure 14: Structured Description 2

2. The method according to Item 1 further comprising the step of adding a second carbohydrate component on top of the protein component.

The remaining Items are developed in a similar manner adding functions back into the function model until all of the functions marked with a red X have been restored.

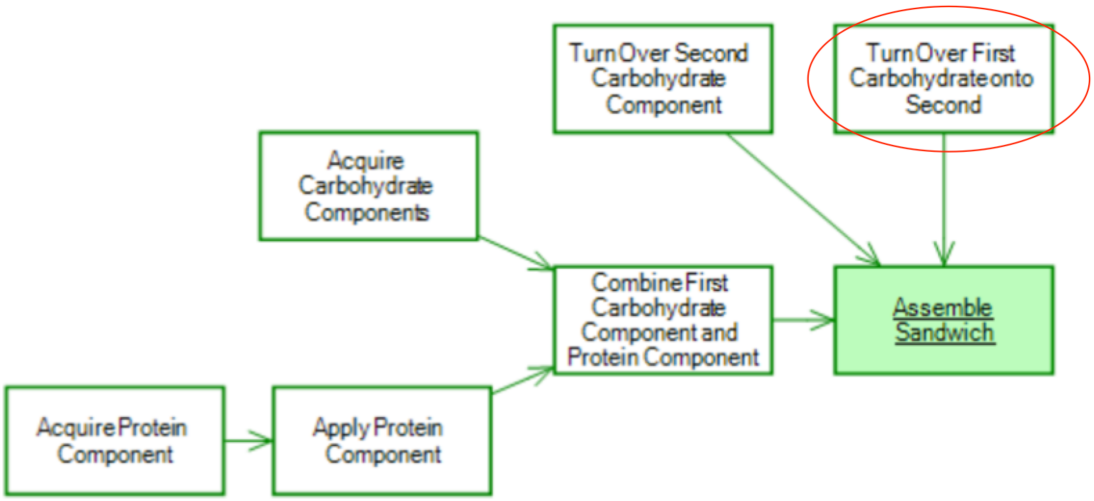

Figure 15: Structured Description 3

3. The method of Item 1 further comprising a second carbohydrate component in which the combined protein component and first carbohydrate component are placed on top of said second carbohydrate component.

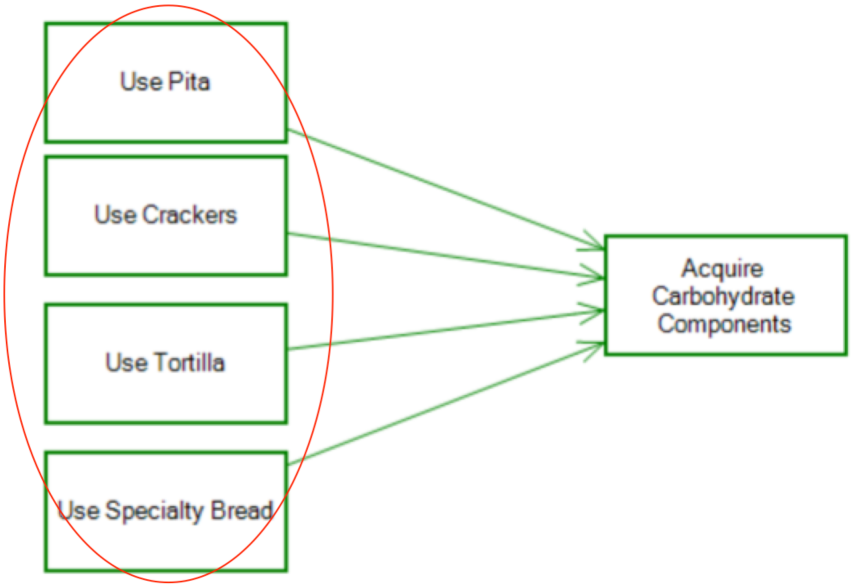

Figure 16: Structured Description 4 and 5

4. The method of Item 1 where the first carbohydrate component is comprised of bread, pita, cracker, tortilla, or pancake.
5. The method of Item 2 where the second carbohydrate component is comprised of bread, pita, cracker, tortilla, or pancake.

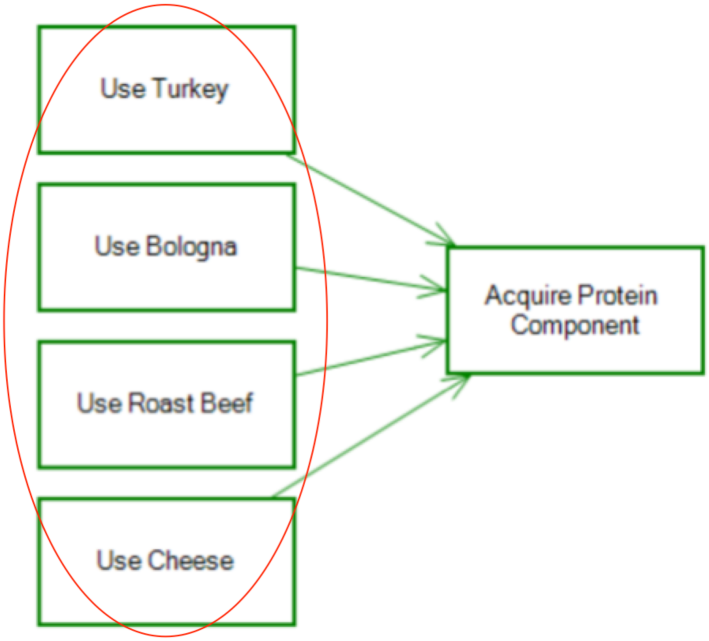

Figure 17: Structured Description 6

6. The method of Item 1 where the protein component is comprised of ham, turkey, bologna, salami, pepperoni or cheese.

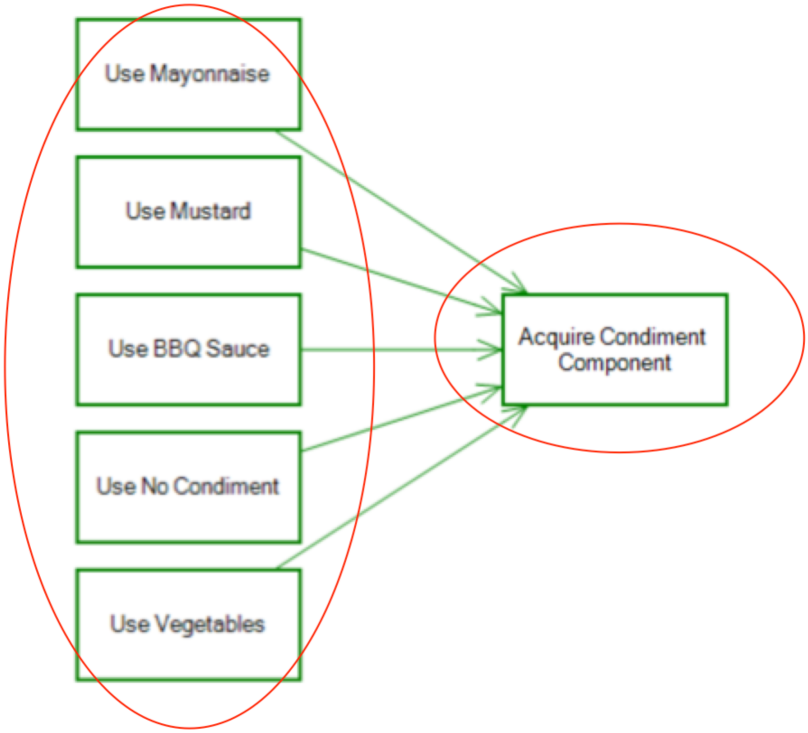

Figure 18: Structured Description 7 and 8

7. The method of Item 1 comprising the further step of adding a condiment.
8. The method of Item 7 where the condiment is comprised of mayonnaise, mustard, BBQ sauce or vegetables.

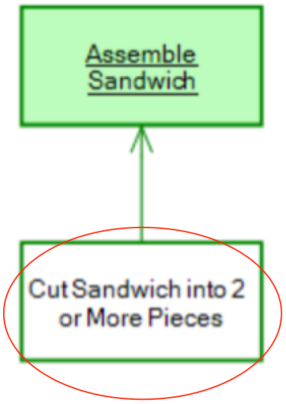

Figure 19: Structured Description 9

9. The method according to any of the above Items in which the sandwich is cut into two or more pieces.

The Structured Description development process continues until all of the functions starting from the Foundation Model through the Complete Patent Model have been included. Function modeling provides a method to deconstruct the invention and configure it in a way that makes eventual patent development both efficient and thorough. A summary of our ham sandwich Structured Description is shown in Figure 20. By nature the Structured Patent Development Method produces a Structured Description of a method. A Structured Description of the apparatus can easily be derived from the Structured Description of the method.

1. A method for preparing a sandwich comprising the steps of placing a protein component on top of a first carbohydrate component
2. The method according to Item 1 further comprising the step of adding a second carbohydrate component on top of the protein component.
3. The method of Item 1 further comprising a second carbohydrate component in which the combined protein component and first carbohydrate components are placed on top of said second carbohydrate component.
4. The method of Item 1 where the first carbohydrate component is comprised of bread, pita, cracker, tortilla, or pancake.
5. The method of Item 2 where the second carbohydrate component is comprised of bread, pita, cracker, tortilla, or pancake.
6. The method of Item 1 in where the protein component is comprised of ham, turkey, bologna, salami, pepperoni or cheese.
7. The method of Item 1 comprising the further step of adding a condiment
8. The method of Item 7 where the condiment is comprised of mayonnaise, mustard, BBQ sauce or vegetables
9. 9. The method according to any of the above Items in which the sandwich is cut into two or more pieces

Figure 20: Summary of Structured Description

Conclusions

A method to analyze and expand inventions and develop a Structured Description of the invention has been developed. This method addresses many of the issues that often surround the transition from invention to patent as follows.

- Describing how and why the invention functions.
    - Constructing the Specific Function Model provides an effective means for the inventor and patent attorney to begin communicating. Traditionally, the patent attorney reviews a write up of the invention and discusses the invention with the inventor. The patent attorney does this to understand the how–and-why of the invention. The function model simplifies this communication and makes it easier for a complete description of the invention to follow. In addition, gaining an understanding of the invention through the Specific Function Model will require less time from the patent attorney, assuming the attorney is already familiar with the basics of function models. This first step, building the Specific Function Model, all by itself delivers significant value to both the inventor and the patent attorney by establishing a common language for analysis of the invention.

- Describe the patent in its broadest sense.
    - The Pure Function Model describes the functionality delivered by the invention in the broadest sense. In addition to being useful to determine the boundaries of prior art, the Pure Function Model makes it easier to see other fields where the invention might apply. By considering which other products, processes, technologies, etc. have the same or similar functional issues and needs, application of the invention and the patent can be broadened.

- Describe the broadest invention that is outside of prior art.
    - Building the Base Patent Model from the Specific Function Model and the Pure Function Model provides additional structure and logic to prior art search. By considering corresponding functions in the Specific Function Model and the Pure Function Model, the minimum number of concessions to prior art can be made giving the resulting patent as much breadth as possible.

- Expand the invention to cover all possible variations.
    - Applying TRIZ inventive principles to the Base Patent Model stimulates the inventor to leverage his or her subject matter expertise and expand the invention. Because the TRIZ inventive principles are derived from a very extensive set of known inventions, the inventor will consider expansion options that would otherwise remain undiscovered.

- Define the elements of a broad first independent patent claim.
    - The Foundation Model provides a systematic method to construct a first independent claim of the patent. By systematically removing functions from the Base Patent Model, the minimum functionality required to deliver the primary function of the invention is revealed.

- Describe the elements of the dependent patent claims.

- The Complete Patent Model is an exhaustive description of the invention in diagrammatic form. It is useful not only for patenting purposes, but it is also a simple and effective means to explain to others how and why the invention works.

There are other implications for the Structured Patent Development Method as well.

- Circumvent competitors' patents.
  - An existing patent, perhaps a competitor's patent, can be deconstructed by building a function model from the patent claims. Reverse engineering a patent in this manner makes it easier to find ways to expand upon an existing patent and/or develop functional alternatives to the invention described in the patent. Functional alternatives can then be examined by a patent attorney to determine if the provide the legal basis for a patent outside the prior art of the original patent.

- Expand the invention to other applications not anticipated in the current invention.
  - Limitations in the current invention can be added to the Complete Function Model as harmful functions. With the addition of harmful functions, there are three opportunities to improve upon the invention. You can find ways to improve useful functions, find ways to counteract harmful functions and find ways to resolve contradictions among useful and harmful functions. The TRIZ inventive principles can be used to exhaustively search for these new opportunities. The inclusion of harmful functions followed by application of the TRIZ inventive principles results in new product and process ideas that can form the basis of completely new inventions.