So, what’s the deal with patents?

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DISCLAIMER!

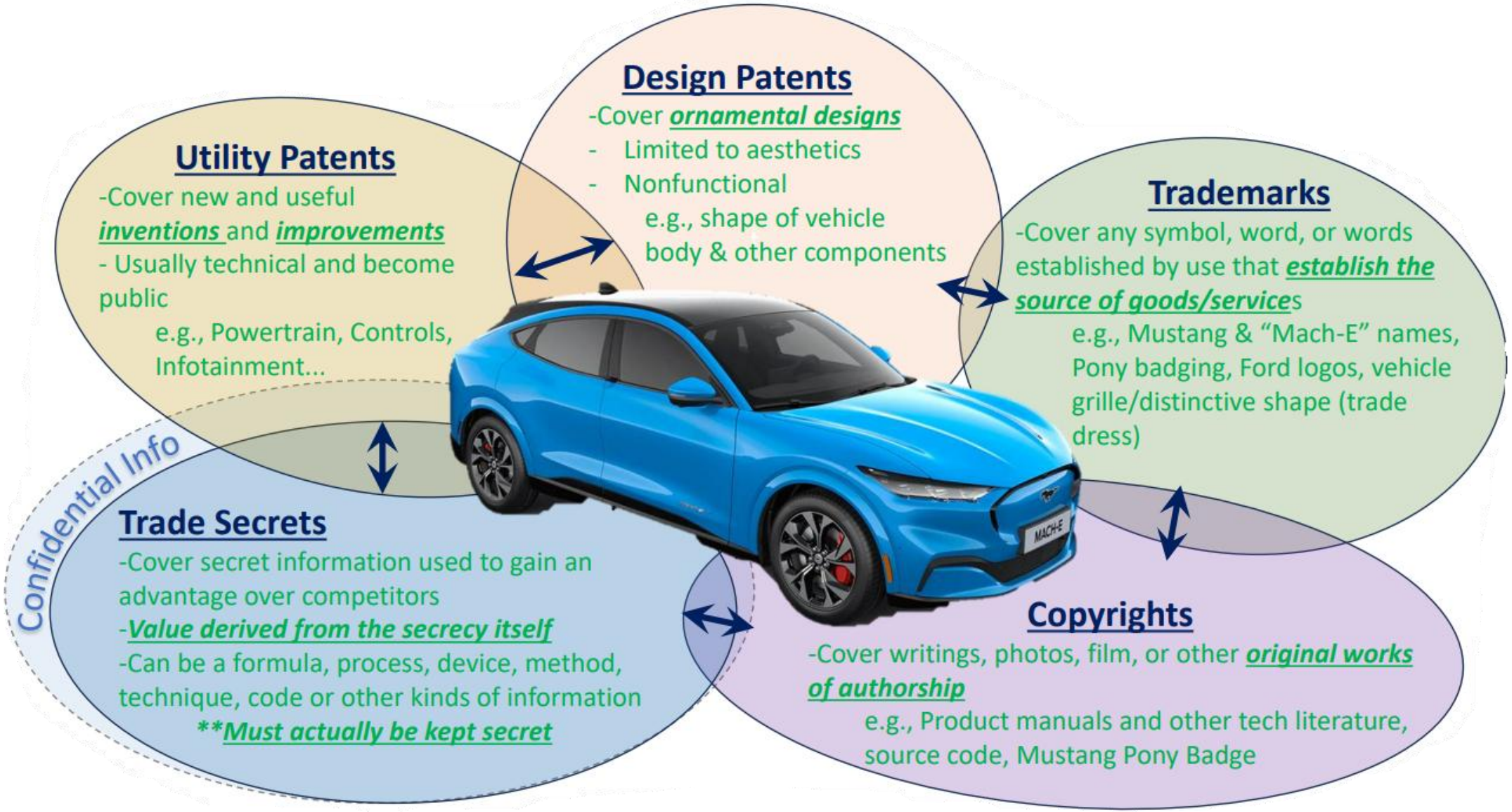
We (the authors of this presentation) are not lawyers and we are not offering legal advice. We present this content from the perspective of inventors with many years of experience and success.

Consult your organization’s legal team for detailed information!!

A patent:

- Is a time-bound contract (20 years) between an owner of the patent and a government granting the owner the **exclusive** right to use their invention in exchange for teaching the world.
- Includes specific claims that identify the exact features that are required parts of the invention
- Grants legal rights to enforce exclusivity.
- Is transferrable (can be sold or donated), or can be used as the basis of a licensing contract to allow others to use the technology
- The patent is given (if allowed) to the first inventor to file an application for a given invention

Patents Are A Subset Of Intellectual Property…



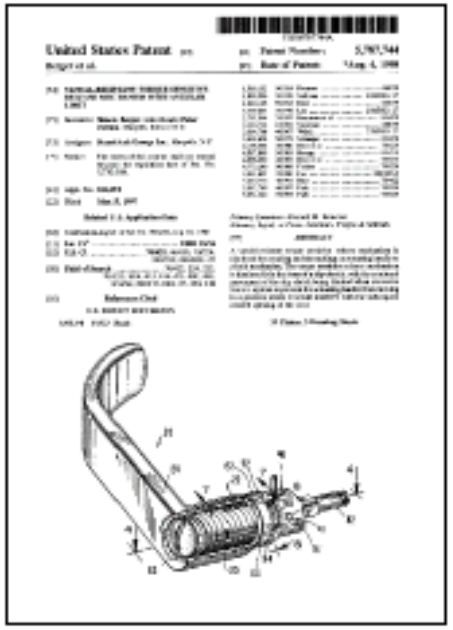
Types of Patents

Utility

Protects how an invention works, functions, or is made

Protection for 20 years from filing date:

- Process
- Machine
- Article of manufacture
- Composition of matter



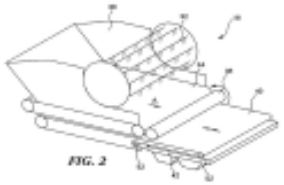
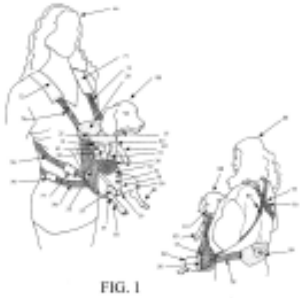
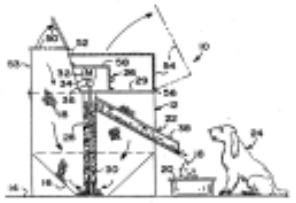
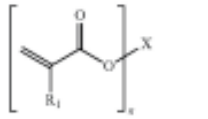
Design

Protects the way a product or article of manufacture looks (the appearance) for 15 years from the date of grant

Plant

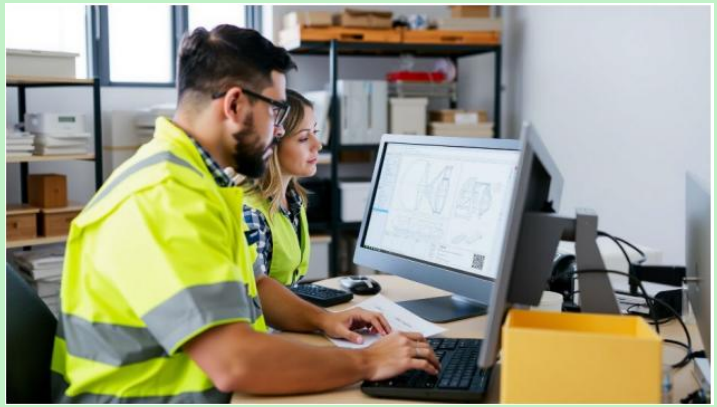
Protects newly invented strains of asexually reproducing flowering plants, fruits trees, and other hybrid plants for 20 years from filing date

Categories of Utility Inventions

CATEGORY	Process ("actions" — i.e., an invention claimed as an act or step, or a series of acts or steps — or "method")	Manufacture ("a tangible article that is given a new form, quality, property, or combination through man-made or artificial means")	Machine ("concrete thing, consisting of parts, or of certain devices and combination of devices")	Composition of matter ("combination of two or more substances and includes all composite articles")
EXPLANATION	An act, or a series of acts, performed upon the subject-matter to be transformed or reduced to a different state or thing.	An article produced through manufacturing, wherein the article is formed from starting materials that have been altered or arranged to have new forms, qualities, properties, or combinations. Also includes the parts of a machine considered separately from the machine itself.	Includes every mechanical device or combination of mechanical powers and devices to perform some function and produce a certain effect or result.	Includes all compositions of two or more substances. Also, all composite articles, whether they be the results of chemical union or of mechanical mixture, or whether they be gases, fluids, powders or solids.
EXAMPLE	**U.S. Patent No. 6,048,556:** Method for making a stuffed pizza crust 	**U.S. Patent No. 10,321,661:** Personal dog carrier harness system with integrated internal support and padded neck support 	**U.S. Patent No. 5,363,805:** Automatic pet feeder 	**U.S. Patent No. 11,319,468:** Adhesive composition  

Inventorship

Who IS an Inventor?



- Anyone who **contributed** a definite and permanent idea of the complete and operative invention.
- An inventor must be able to point to something in the invention and say, **“That’s my contribution.”**
- Inventors must share some degree of joint behavior, connection, or open line of communication, such as collaboration or working under common direction.

Who IS NOT an Inventor?

- Someone who provided no contribution to the conception of the invention, even if they attended a meeting in which the invention is conceived or discussed
- Suggests a desired result w/o the means of accomplishing it.
- Someone who merely follows directions in support of the effort, or someone whose only role is to supervise the inventors.

Role of Artificial intelligence

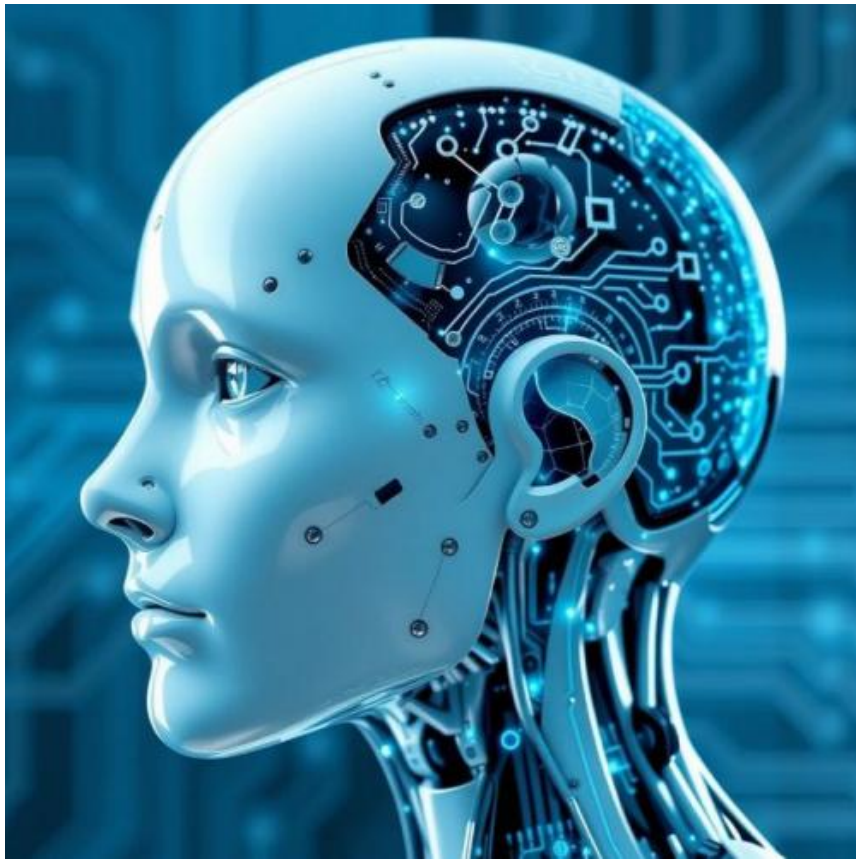
Only *Natural Persons* Can Be Inventors, as per USPTO Guidance & Legal Precedent

- U.S. patent law currently requires an **'inventor'** to be a **“natural person”** (i.e. a human)
- A.I. systems cannot *currently* be named as an inventor or co-inventor and owners of A.I. systems cannot claim ownership of inventions created with the aid of A.I. systems… *currently*.

AI-assisted inventions are patentable only with significant human contribution

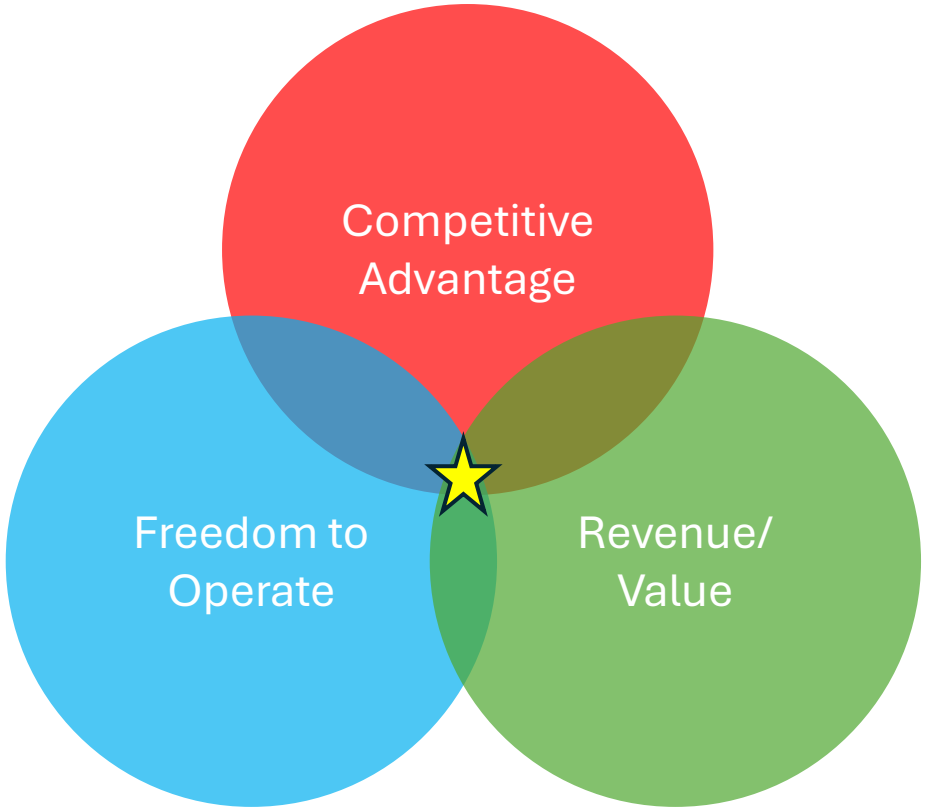
- If you use an A.I. tool to realize your inventive concept, you are the inventor, but this is an evolving space – be cautious!
- Use of A.I. is currently viewed as just another tool similar to:
  - CAD software for an engineer
  - Advanced lab equipment for a scientist

Remember, A.I. tools use your inputs to continuously learn and the owner of the tool is under no obligation to keep your ideas secret!



The use of A.I. in invention is an d evolving space

Why **should** you patent something??



Industry:

1. Ability to exclusively market a product or feature (competitive advantage)
2. Obtain Revenue from licensing/ sale of the technology to others
3. Assure freedom to operate and limit risk of paying someone else licensing fees

Academia:

1. Revenue from licensing/ sale of technology
2. Freedom to operate

Startups:

1. Establish protected space to develop business plan (freedom to operate)
2. Proof of value to investors (competitive advantage)
3. Potential future licensing revenue

Patent Assertion Entity:

1. Obtaining settlement/licensing revenue

Hierarchy Of Value

- You own a patent on an idea that is key to your product or process, and it is essential to anyone implementing a similar product
- The technology is known and nobody owns it, so it's free to use, but you have no exclusive use of it.
- A technology is key to your operation and somebody else owns the technology and you must pay or are prohibited from using it

- *It may be important to patent an idea to capture revenue or to secure freedom to operate.*
- *Even if the technology is not clearly key to your current operation, it may be valuable in some future scenario, either to generate licensing revenue or to sell or trade.*
- *If your idea is not patented, you can protect your company's ability to operate by publishing the concept to prevent someone else from patenting it.*

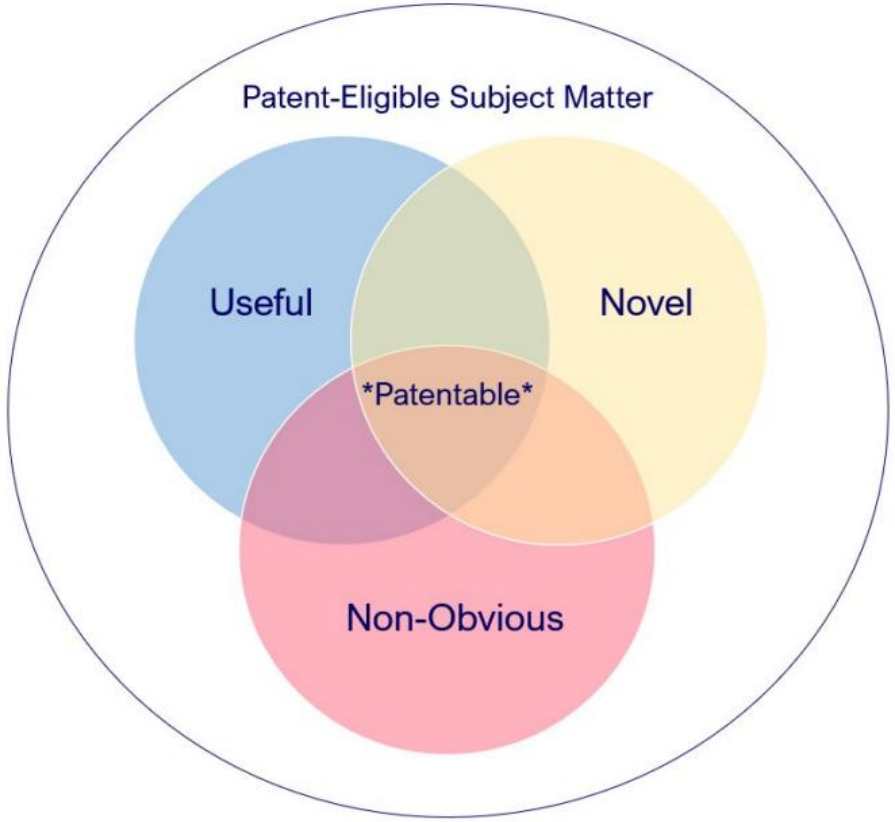
Why ***Shouldn't*** You Patent An Idea?

1. Cost.
2. Detectability. Infringement is not easily detectable, making enforcement difficult
3. It's better to keep the idea as an internal secret rather than teaching the world (***trade secret***)
4. Obtaining a patent limits the ability of key partners to operate successfully (e.g., a JDA partner)
5. Altruism. Too valuable to the world to restrict (e.g., the polio vaccine)
6. PR. Claiming ownership of an idea is bad for public relations
7. Not your idea (don't steal ideas of others)

What Are The Required Features Of An Invention For Patenting?

To be patentable an invention must be:

- **Eligible Subject Matter** – A process, machine, manufacture, or composition of matter and **not** an "abstract" idea, law of nature, or natural phenomena.
- **Useful** – It must have a practical purpose, physically accomplish something, and feasibly function.
- **Novel** – It must be new and different from anything already in the public domain.
- **Non-Obvious** – Someone *skilled in the art* wouldn't consider it obvious and implementing it requires a different design or process than is currently used .
  - *Examples of obvious solutions:* Merely substituting a material, moving a known feature from one location to another, or simply 3D printing a known object used for its intended known purpose.



Inventing: From Inspiration To An Invention Disclosure

Moment of Insight
Usually in the form of a solution
(new way to do something)

Ideation

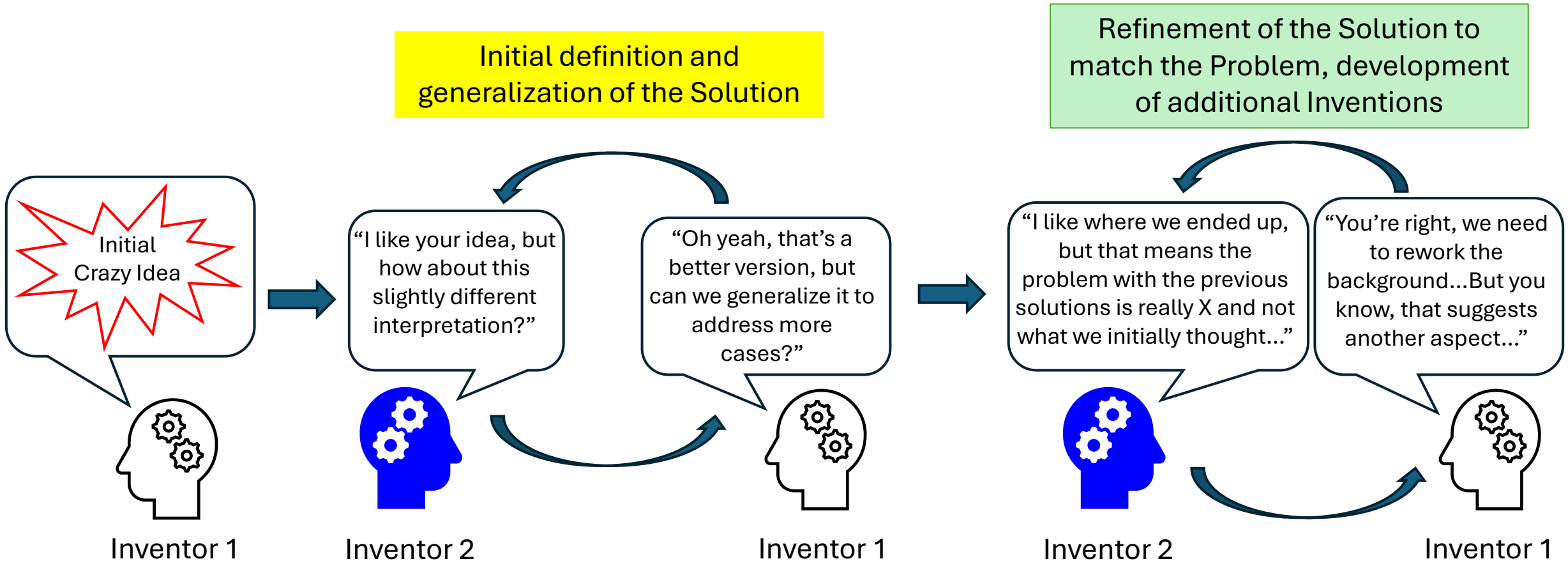
- Build on Insight
- Locate true Solution and scope
- Refine understanding of Problem
- Initial illustrations, examples

Create a Narrative for the Disclosure

- Develop figures
- Define ranges, limits
- Describe examples
- Submission into you ID system

Define and Refine a Problem and Solution Narrative

*One of the most common and best ways to guide the process is to frame the invention as a **Solution** to a specific **Problem** not solved by previous approaches*



Don't kill the process with "That won't work…".

Inventing is like consulting an Ouija board – everyone has to help guide the group to a common idea. Instead of negative statements, pivot to better ideas.

Systematically Peeling The Onion To Find Questions And Answers

By asking repeated “Why?” questions, you can locate areas for development or build a more detailed problem description and answer the “obviousness” question

Why are my images blurry?

1. **The detector doesn’t have enough resolution**

   Why can’t we make the pixels smaller?

   You’ll lose detection efficiency

   Why does the efficiency go down?

   Because the pixels get thinner and absorption falls

   Why do the pixels have to get thinner?

   There’s a limit to the aspect ratio of a pixel on an IC

   Why can’t we use a different geometry of the detector to allow for high-aspect ratio pixels?

2. **The source focal spot is too large**

   Why can’t we focus the beam to a smaller spot?

   Because the heat loading on the target is too high to reject heat effectively

   Why can’t the target take more heat?

   Because it erodes (evaporates) and becomes rough at these temperatures

   Why can’t we remove the heat more effectively?

   Because the thermal conductivity of the target material is limiting

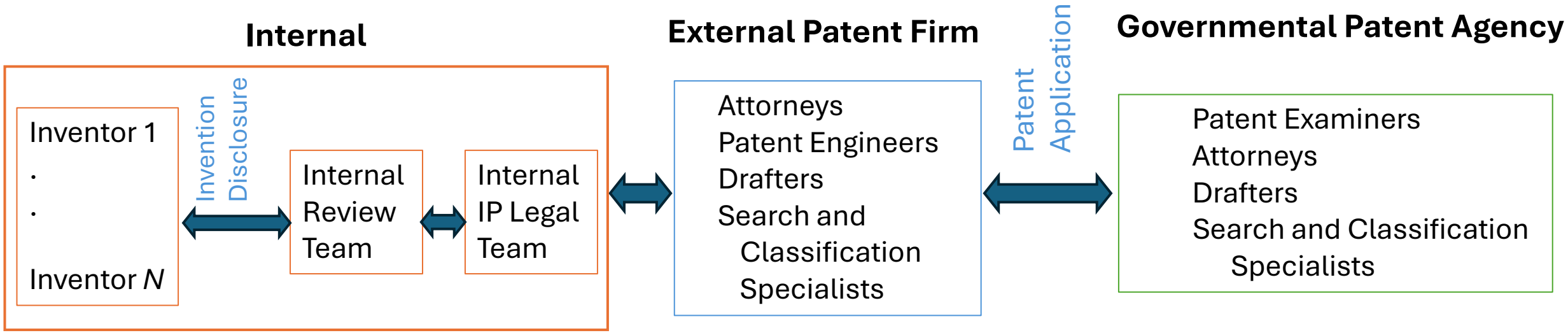
   Why does the target material and the heat sink have to be the same material?

3. **The collimating optics have poor efficiency….**

Getting Your Idea To The Patent Office

Each organization is different, but the process always starts with an idea (Invention Disclosure) that is handed-off to patent attorneys for filing as an application to a government agency (e.g., USPTO).

Your organization may also have an internal review between the inventors and the lawyers to limit expense and prevent ill-conceived ideas from going forward.



Building an Invention Disclosure Through a Problem/Solution Narrative

A key part of a successful invention is explaining the idea clearly. A scribbled diagram on a napkin may be enough for you, but you must convince others to be successful.

Outline of narrative:

Title (this should point the reader to a simple, clear picture of what you're proposing)

Abstract (a short summary of the what you're going to propose)

Problem

- What is the basic problem (drill down to the precise problem here)
- What has been tried in the past to solve it (prior art) and what are the defects in those past methods

Solution

- What is your proposed solution
- How does it solve the basic problem (be specific)
- How does your solution overcome the failures of previous solutions
- ❖ How is your solution new, useful and non-obvious
- ❖ Ancillary benefits of your solution

Examples

Preferred and alternative embodiment for your invention (ranges and limits)

Diagrams

Must be clearly connected to your solution and illustrate preferred embodiments and features

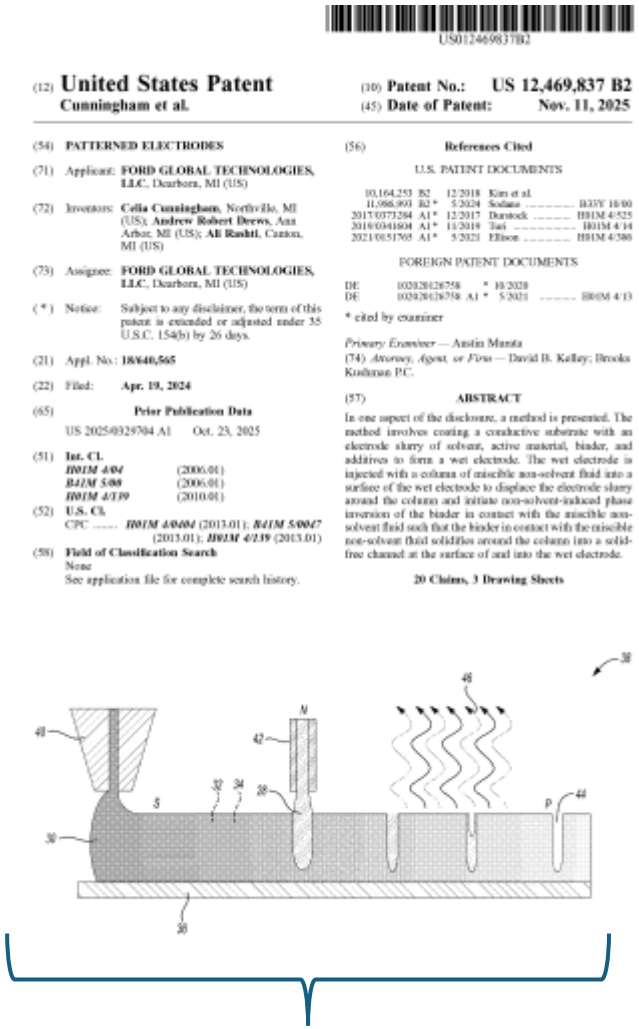
Claims (optional)

- Must be supported by the description of your solution and reflect your preferred embodiment
- Independent claims
  - ➢ start with the most basic and general description of your solution that is still unique
- Dependent claims
  - ➢ built off of the independent claims to capture a broader scope, but not a new invention

General Advice For Crafting the Narrative

- Be specific – Peel back the layers of the onion as far as you can to reveal the clearest statement of the problem possible, and exactly how your solution solves that problem, is new and not obvious.
  - **Failing to address these key requirements is an open invitation to the Examiner to reject your claims.**
- Make sure your title, description, background, problem and solution are aligned!
- Data is important, but data can be in many forms – don't wait to start the process just because ***you*** are struggling to complete the perfect experiment.
- Use tools (Google Patents, USPTO Search, Google, AI) to find prior art and bolster your case, but don't assume that any single resource will have all the answers.

What A Patent Looks Like



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(12) **United States Patent**
Cunningham et al.

(10) **Patent No.: US 12,469,837 B2**
(45) **Date of Patent: Nov. 11, 2025**

(54) **PATTERNED ELECTRODES**

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(73) Assignee: **FORD GLOBAL TECHNOLOGIES, LLC**, Dearborn, MI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 26 days.

(21) Appl. No.: **18/640,565**

(22) Filed: **Apr. 19, 2024**

(65) **Prior Publication Data**

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(51) **Int. Cl.**
H01M 4/04 (2006.01)
H01M 5/00 (2006.01)
H01M 4/139 (2010.01)

(52) **U.S. Cl.**
CPC ***H01M 4/0404*** (2013.01); ***H01M 5/0047*** (2013.01); ***H01M 4/139*** (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

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(57) **ABSTRACT**

In one aspect of the disclosure, a method is presented. The method involves coating a conductive substrate with an electrode slurry of solvent, active material, binder, and additives to form a wet electrode. The wet electrode is injected with a column of miscible non-solvent fluid into a surface of the wet electrode to displace the electrode slurry around the column and initiate non-solvent-induced phase inversion of the binder in contact with the miscible non-solvent fluid such that the binder in contact with the miscible non-solvent fluid solidifies around the column into a solid-free channel at the surface of and into the wet electrode.

20 Claims, 3 Drawing Sheets

1

PATTERNED ELECTRODES

TECHNICAL FIELD

The disclosure relates to electrode materials for lithium-ion batteries.

BACKGROUND

Lithium-ion batteries, integral to various technological applications, feature porous electrodes permeated by a liquid electrolyte. This design facilitates the movement of lithium ions through electrolyte-filled channels toward the active material within the electrode. However, the efficiency of this ion transport is influenced by the electrode's tortuosity, which characterizes the path length of ion travel relative to the direct distance between two points. A tortuosity greater than 1 indicates a non-linear path that increases the distance ions must travel, altering transport properties like diffusivity and conductivity.

Elevated tortuosity can lead to compositional gradients within the electrode, affecting the electrode's potential and potentially leading to lithium plating on the negative electrode. Lithium plating reduces battery capacity and can contribute to the formation of lithium dendrites. Additionally, tortuosity imposes design limitations on lithium-ion batteries by limiting the practical thickness of electrodes. Thicker electrodes exacerbate transport limitations, hindering the battery's performance.

SUMMARY

In one aspect of the disclosure, a method is presented. The method involves coating a conductive substrate with an electrode slurry of solvent, active material, binder, and additives to form a wet electrode. The wet electrode is injected with a column of miscible non-solvent fluid to displace the electrode slurry mixture around the column and initiate non-solvent-induced phase inversion of the binder in contact with the miscible non-solvent fluid such that the binder in contact with the miscible non-solvent fluid solidifies around the column into a solid-free channel at a surface of and into the wet electrode.

The column may be injected into the surface of the wet electrode by ink-jet deposition. The active material may be lithium-based. The solvent may be N-methyl-2-pyrrolidone. The binder material may be polyvinylidene fluoride. The miscible non-solvent fluid may be water-based. The active material may be graphite-based. The solvent may be water-based. The binder may be carboxymethyl cellulose. The miscible non-solvent fluid may be acetone-based.

In another aspect of the disclosure, a method of forming a solid-state battery cell is presented. The method involves injecting a slurry of solid electrolyte and non-solvent into a wet electrode coating including active material and binder to displace the wet electrode coating around the slurry and initiate non-solvent-induced phase inversion of the binder in contact with the slurry such that the binder in contact with the slurry solidifies around the slurry into a pit in the wet electrode. The slurry may be injected into the wet electrode coating by ink-jet deposition.

In yet another aspect of the disclosure, a method is presented. The method includes mixing an active material, solvent, and polymer binder to form an electrode slurry mixture, coating the electrode slurry mixture onto a current collector to form a wet electrode, and injecting a column of miscible non-solvent fluid into the wet electrode to form a channel at a surface of and into the wet electrode after evaporation of the miscible non-solvent fluid and solvent.

The column may be injected into a surface of the wet electrode by ink-jet deposition. The active material may be lithium-based. The solvent may be N-methyl-2-pyrrolidone and the binder may be polyvinylidene fluoride. The non-solvent may be water-based. The active material may be graphite-based. The solvent may be water-based, and the binder may be carboxymethyl cellulose. The non-solvent may be acetone-based.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1**A and **1**B are ternary phase diagrams of slurry, binder, and non-solvent according to one or more aspects of the disclosure;

FIG. **2** is a flowchart of a method according to any one or more aspects of the disclosure;

FIG. **3** is a flowchart of a method of forming a solid-state battery according to any one or more aspects of the disclosure;

FIG. **4** is a flowchart of a method according to any one or more aspects of the disclosure; and

FIG. **5** is a schematic diagram of a manufacturing process according to any one or more aspects of the disclosure.

DETAILED DESCRIPTION

Embodiments are described herein. It is to be understood, however, that the disclosed embodiments are merely examples and other embodiments may take various and alternative forms. The figures are not necessarily to scale. Some features could be exaggerated or minimized to show details of particular components. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a representative basis for teaching one skilled in the art.

Various features illustrated and described with reference to any one of the figures may be combined with features illustrated in one or more other figures to produce embodiments that are not explicitly illustrated or described. The combinations of features illustrated provide representative embodiments for typical applications. Various combinations and modifications of the features consistent with the teachings of this disclosure, however, could be desired for particular applications or implementations.

The term "electrode" means a conductor through which electricity enters or leaves an object, substance, or region within the context of a lithium-ion battery or similar energy storage device. In the operation of such batteries, electrodes facilitate the movement of electrons, contributing to the battery's charge and discharge cycles. The term "solvent" refers to a substance, which may be a liquid, that can dissolve other substances. The term "non-solvent fluid" refers to a liquid that does not dissolve a particular substance but is used within the specific process described to induce phase changes in the material. The term "slurry" denotes a semi-liquid mixture, generally composed of fine particles of a solid material suspended in a liquid. The term "phase inversion" signifies a process by which a material transitions from a liquid phase to a solid phase.

The disclosure relates to methods for forming low-tortuosity channels within a thickness of an electrode, by injection of a non-solvent fluid into a wet electrode slurry coating. This approach displaces solids, extending from a surface of the electrode into the electrode. The subsequent evaporation of the non-solvent, alongside the slurry solvent

. . . .

5

ride or other suitable cathode binder materials may be chosen for their electrochemical stability and strong adherence to the active material. The non-solvent for cathode configurations may be water-based, which is miscible with n-methyl-2-pyrrolidone while precipitating polyvinylidene fluoride, facilitating the phase inversion process required to create the low-tortuosity channels. For anode configurations, the active material may be graphite-based. The solvent used for anode configurations may be water-based, due to its ability to effectively disperse anode binder, which may be carboxymethyl cellulose. Carboxymethyl cellulose or other appropriate anode binder materials may be selected for their ability to facilitate ion transfer and adhere to the active material. The non-solvent for the anode configuration may be acetone-based, which is miscible with water while not dissolving carboxymethyl cellulose, thereby enabling the phase inversion process necessary to create the low-tortuosity channels.

FIG. **5** shows the injection of a non-solvent **28** into a slurry **30** of a solvent **32** and a polymer binder **34**, after the slurry **30** is deposited onto a substrate **36** to form a wet electrode **38**. As the wet electrode substrate **36** advances from the deposition die head **46**, passing beneath the injection head **42**, the column of non-solvent **28** is applied. This non-solvent column displaces the surrounding slurry **30** and induces the precipitation of the binder **34**, forming a columnar structure or pit **44** around the injection point. During the drying phase **46**, both the solvent **32** and non-solvent **28** are removed through evaporation, leaving the pit **44** intact. During formation of the wet electrode **38** into an electrode assembly, the pit **44** may be filled with suitable electrolyte material, contributing to the low-tortuosity channel network within an electrode by increasing an electrolyte's potential ionic conduction pathways.

While exemplary embodiments are described above, it is not intended that these embodiments describe all possible forms encompassed by the claims. The words used in the specification are words of description rather than limitation, and it is understood that various changes may be made without departing from the spirit and scope of these disclosed materials. The terms "channel" and "channels," for example, can be used interchangeably herein.

As previously described, the features of various embodiments may be combined to form further embodiments of the invention that may not be explicitly described or illustrated. While various embodiments could have been described as providing advantages or being preferred over other embodiments or prior art implementations with respect to one or more desired characteristics, those of ordinary skill in the art recognize that one or more features or characteristics may be compromised to achieve desired overall system attributes, which depend on the specific application and implementation. These attributes may include, but are not limited to strength, durability, marketability, appearance, packaging, size, serviceability, weight, manufacturability, ease of assembly, etc. As such, embodiments described as less desirable than other embodiments or prior art implementations with respect to one or more characteristics are not outside the scope of the disclosure and may be desirable for particular applications.

What is claimed is:

1. A method comprising:
coating a conductive substrate with an electrode slurry of solvent, active material, binder, and additives to form a wet electrode; and

6

injecting a column of miscible non-solvent fluid into a surface of the wet electrode to displace the electrode slurry around the column and initiate non-solvent-induced phase inversion of the binder in contact with the miscible non-solvent fluid such that the binder in contact with the miscible non-solvent fluid solidifies around the column into a solid-free channel at the surface of and into the wet electrode.

2. The method of claim **1** wherein the column is injected into the surface of the wet electrode by ink-jet deposition.

3. The method of claim **1** wherein the active material is lithium-based.

4. The method of claim **3** wherein the solvent is N-methyl-2-pyrrolidone.

5. The method of claim **3** wherein the binder is polyvinylidene fluoride.

6. The method of claim **3** wherein the miscible non-solvent fluid is water-based.

7. The method of claim **1** wherein the active material is graphite-based.

8. The method of claim **7** wherein the solvent is water-based.

9. The method of claim **7** wherein the binder is carboxymethyl cellulose.

10. The method of claim **7** wherein the miscible non-solvent fluid is acetone-based.

11. A method of forming a solid-state battery cell comprising:
injecting a slurry of solid electrolyte and non-solvent into a wet electrode coating including active material and binder to displace the wet electrode coating around the slurry and initiate non-solvent-induced phase inversion of the binder in contact with the slurry such that the binder in contact with the slurry solidifies around the slurry into a pit in the wet electrode coating.

12. The method of claim **11** wherein the slurry is injected into the wet electrode coating by ink-jet deposition.

13. A method comprising:
mixing active material, solvent, and polymer binder to form an electrode slurry mixture;
coating the electrode slurry mixture onto a current collector to form a wet electrode; and
injecting a column of miscible non-solvent fluid into the wet electrode to form a channel at a surface of and into the wet electrode after evaporation of the miscible non-solvent fluid and the solvent.

14. The method of claim **13** wherein the column is injected into the wet electrode by ink-jet deposition.

15. The method of claim **13** wherein the active material is lithium-based.

16. The method of claim **15** wherein the solvent is N-methyl-2-pyrrolidone and the polymer binder is polyvinylidene fluoride.

17. The method of claim **15** wherein the miscible non-solvent fluid is water-based.

18. The method of claim **13** wherein the active material is graphite-based.

19. The method of claim **18** wherein the solvent is water-based and the polymer binder is carboxymethyl cellulose.

20. The method of claim **18** wherein the miscible non-solvent fluid is acetone-based.

* * * * *

Cover Page: Title, Number, Inventors, Owners, Classification, Abstract,..

Specification, Examples

Claims

Types of Patent Applications

In the US, there are two main types of patent applications: Provisional and Non-Provisional.

A Provisional patent application is a low-cost, fast way to establish temporary protection.

- Discloses outline of invention
- Enables a claim of ownership (Patent Pending) for up to 1 year
- Must be followed up with a Non-Provisional application for protection beyond 1 year period is needed

A Non-Provisional patent application is the process to obtain a final contract between the invention owner and the government.

- Discloses full description of invention (teaches the world)
- Includes prior art citations, figures, preferred embodiments, applicable ranges
- Specific claims

Considering Prior Art

What is it?

***Everything* publicly known/available before your application was received**

- Patents and published Patent Applications (domestic & international)
- Printed publications (e.g. journal articles, books, conference papers, etc.)
- **Your Idea – if revealed to the public before filing a patent application**

Its Impact

#1 reason preventing an idea from becoming a patent

- Can reveal your idea to be not novel or non-obvious
- Could lead to Patent Examiner to reject application or claims

What You Can Do

Be proactive

- Do a preliminary search to understand the current state of the art, cite it and describe its failings
- Revise and improve upon your idea focusing key differences and advantages
- Frame your concept in terms of how it's not just a variation of what currently exists

What About Data?

Data to support your idea can encompass many things. It ***may*** include:

- actual measurements you performed
- published data that illustrates plausibility of key features (but not your idea)
- basic physical laws in the form of equations
- examples from a similar (but non-obvious) applications
- tabulated data
- engineering principles,…

Don’t get hung-up on proving the idea yourself before submitting! You may not have the capability, expertise or equipment to do the perfect demonstration, but that doesn’t mean you can’t own a patent on it.

Crafting The Application and Claims

In the end, an application must also include specific claims that define the inventions. In the US, a patent application may include up to 20 claims

Sets of claims begin with at least one independent claim, followed by dependent claims

Claims (19)

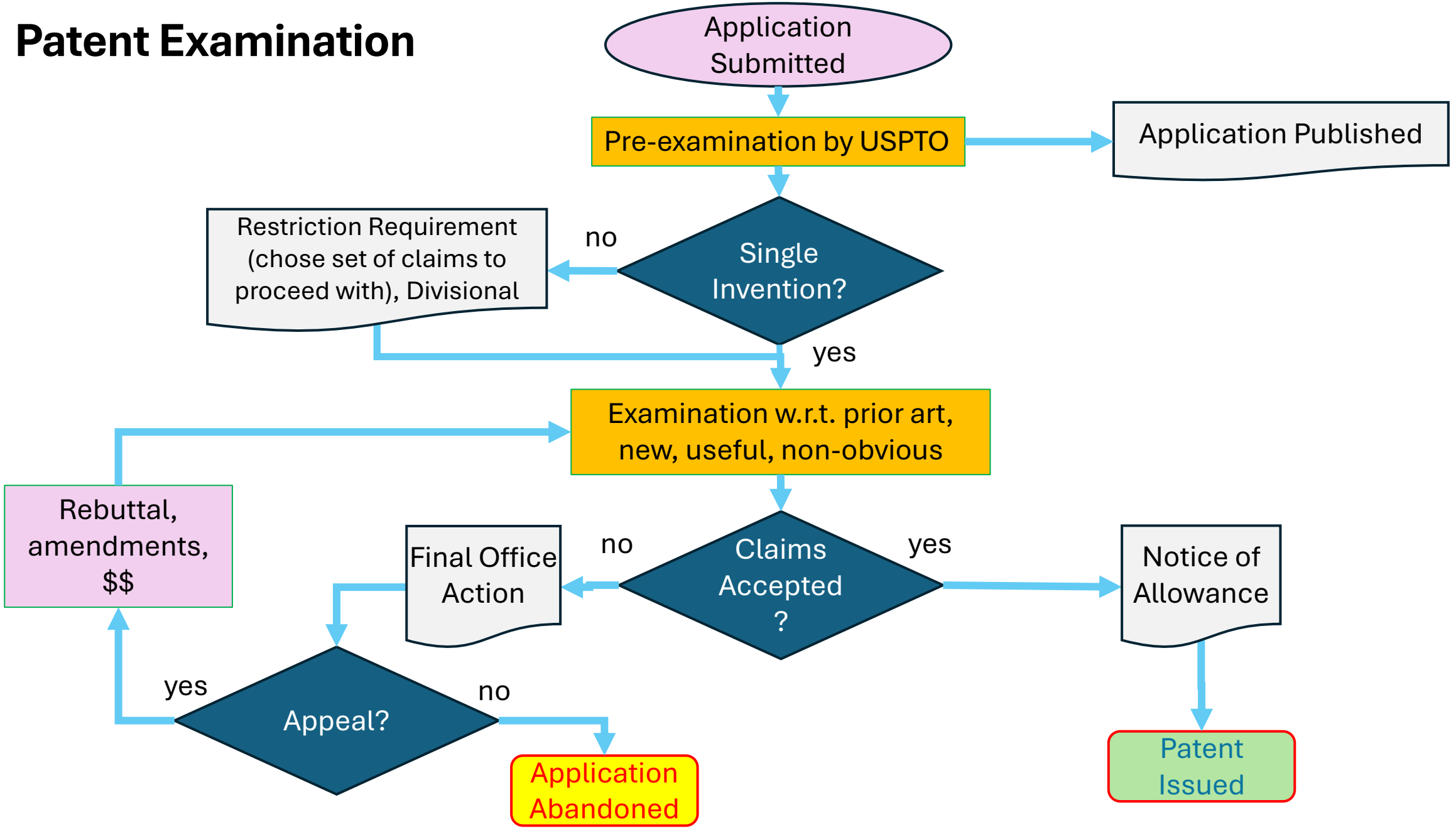
1. A hybrid oxidation catalyst system for use with remediating a lean emission from a vehicle, the catalyst system comprising:

    a noble metal catalyst having noble metal particles in a first ceramic layer disposed on a first substrate; and
    a base metal oxide catalyst disposed downstream of the noble metal catalyst, the base metal oxide catalyst comprising base metal oxide particles in a second ceramic layer disposed on a second substrate wherein the noble metal catalyst is effective to substantially prevent hydrocarbon or carbon monoxide inhibition of the base metal oxide catalyst when enhancing the $NO+O_2$ conversion effectiveness of the base metal oxide catalyst and the base metal oxide catalyst includes at least one of an amount of Mo ranging from 1.14 wt. % to 5 wt. % or W ranging from 1.67 wt. % to 3.4 wt. % of the base metal oxide catalyst remediating at least 20% of NO at temperatures ranging from 125° C. to 150° C.

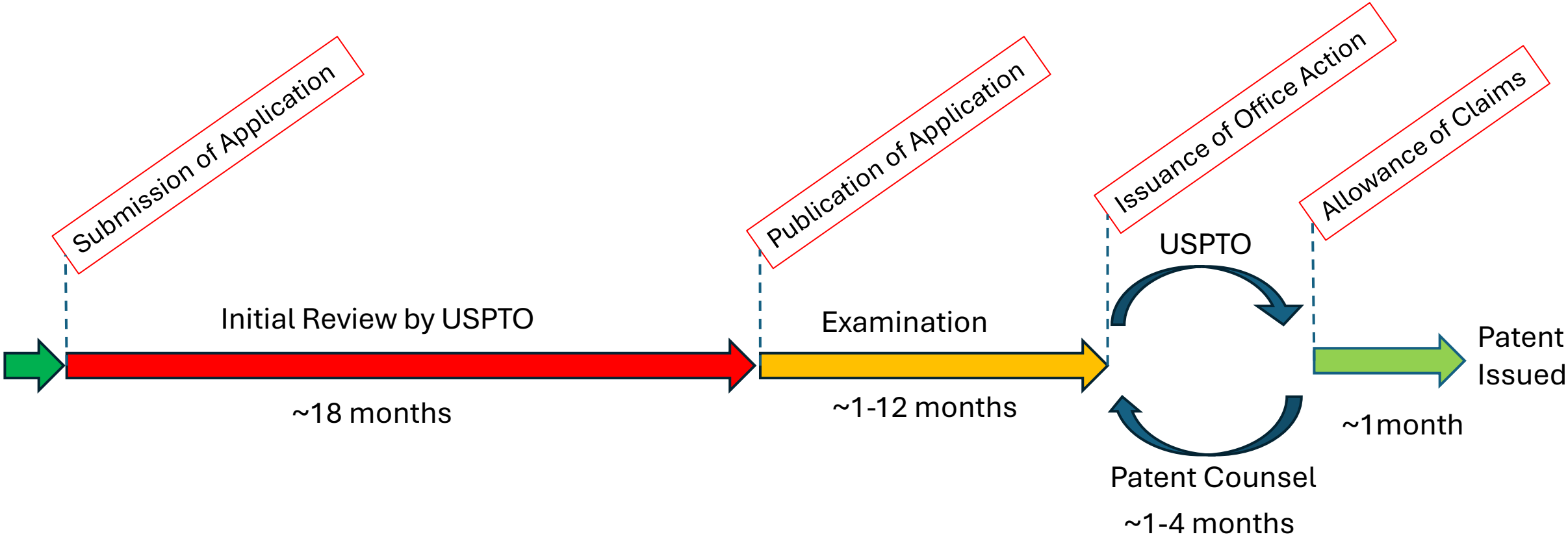
2. The catalyst system of claim 1, wherein the noble metal particles include palladium metal particles having a ratio of total non-palladium noble metal content to palladium metal content ranging from 0 to 5.
3. The catalyst system of claim 2, wherein the base metal oxide is selected from the group consisting of lanthanide oxides, actinide oxides, transition metal oxides, and mixed metal oxides thereof.
4. The catalyst system of claim 3, wherein the base metal oxide is promoted by a metal oxide compound where the metal of the metal oxide compound is selected from the group consisting of tungsten, molybdenum, manganese, iron, and copper, at a temperature in a range of 75° C. to 225° C. when oxidizing $NO+O_2$ to NO_2.

US8304366B2, Drews and Kudla

Patent Examination



Timeline From Submission to Patent



It is **typical** for some claims to be rejected in a Final Office Action letter, but this is rarely the end…
Your Patent Counsel will respond to the Office Action, possibly with your input to determine feasibility of rebutting any rejection of claims and the implications of cited prior art for obviousness and novelty.

Publication

After an application is submitted and assigned a **priority date**, the clock starts for the first stage in completing the patent – publication of the application. At this point, your ideas become public information regardless of whether your claims are ultimately granted.

- By default, applications are published 18 months after the filing date. Anything in the application is henceforth “prior art” and considered known for future applications.

- During that 18 months, an application is converted to a specific format, classified and prepared for review by an Examiner. At this point, no judgment has been passed on the content!

Examination

1. After publication, the application is reviewed by an Examiner. There are several possible outcomes:
   a) All claims are accepted (occasionally)
   b) Some claims are accepted and some (or all) are rejected (most common)
   c) Application is judged to contain more than one invention you are instructed to divide the application into a priority set and submit a second application for the second set (infrequently)

2. A formal judgment is communicated back to the firm (Final Office Action), with an opportunity for response. If there is a basis for arguing against the dismissal of claims, the firm responds with arguments (and $$$) and the review continues.... **No new claims or content are allowed**.

3. Finally, whatever claims are accepted are placed in the final patent document along with all the details originally provided.

Other Scenarios (consult a lawyer…)

Divisional Application

The Examiner judges that the application contains more than one invention, and a "Restriction Requirement" demanding that the application be divided into two or more applications is issued. You must then continue with one invention and can place the other claims in a separate "divisional" application and review

> ***No new content is allowed****! The claims carved out of the original must stand on the basis of the same original content disclosed in the original application. Divisional Applications retain the same Priority Date as the original application.*

Continuation of Claims Application (*but wait, there's more…*)

You discover a new set of embodiments after filing for a patent but before it is granted. You can file a Continuation Application using the same specification to encompass additional claims

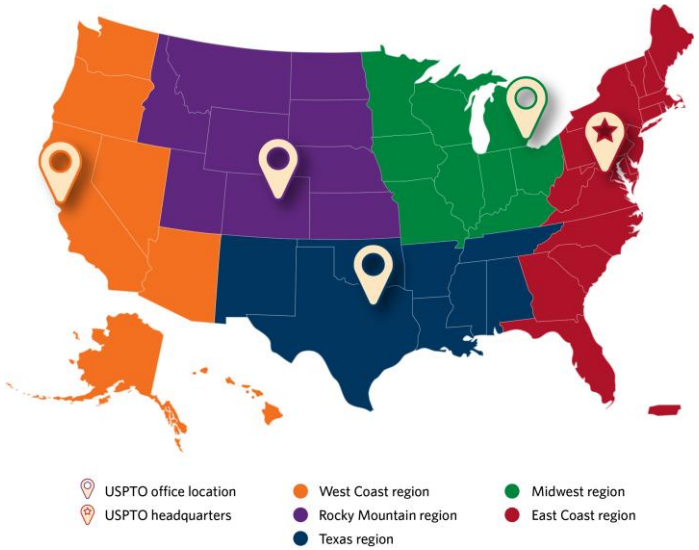
Hard truths about developing IP

- You may not be the first to think your brilliant thought – **check for prior art.**
- The first idea is almost always wrong – **iteration is essential**.
- All ideas are better with more than one inventor's perspective – **collaborate**!
- The biggest killer of collaboration is "that's impossible". Even if you think that a coinventor's idea violates some basic principle of physics, **allow for exploration and evolution of ideas**.
- No matter how much knowledge the reviewers have, they can be misled by a poor narrative. Make sure you **update the problem, solution and title so that they match clearly**.
- No matter how good your idea is, your organization may fail to recognize your genius. **Be prepared to accept defeat and move on**.

U.S. Patent Office Resources

USPTO Headquarters:
- Alexandria, VA

Regional offices:
- Detroit
- Denver
- Silicon Valley
- Dallas



For more information, visit
www.uspto.gov/ptrc

Patent and Trademark Resource Centers (PTRC)
- Nationwide network of public, state, and academic libraries designated by the USPTO to disseminate patent and trademark information and support the intellectual property needs of the public.

USPTO Data & Information Look-up

Developer Hub https://developer.uspto.gov/	Where can I find USPTO open data and services?
Patent Examination Data https://ped.uspto.gov/peds/	What happened in patent applications?
PatentsView https://www.patentsview.org/	Where academics, researchers, and educators go for cool stuff.
Global Dossier https://globaldossier.uspto.gov/	International file histories
Assignment Search https://assignments.uspto.gov/	Who owns this patent/trademark?
PTAB Bulk Data https://developer.uspto.gov/ptab-web/	What happened in patent trials and appeals?

Other Resources

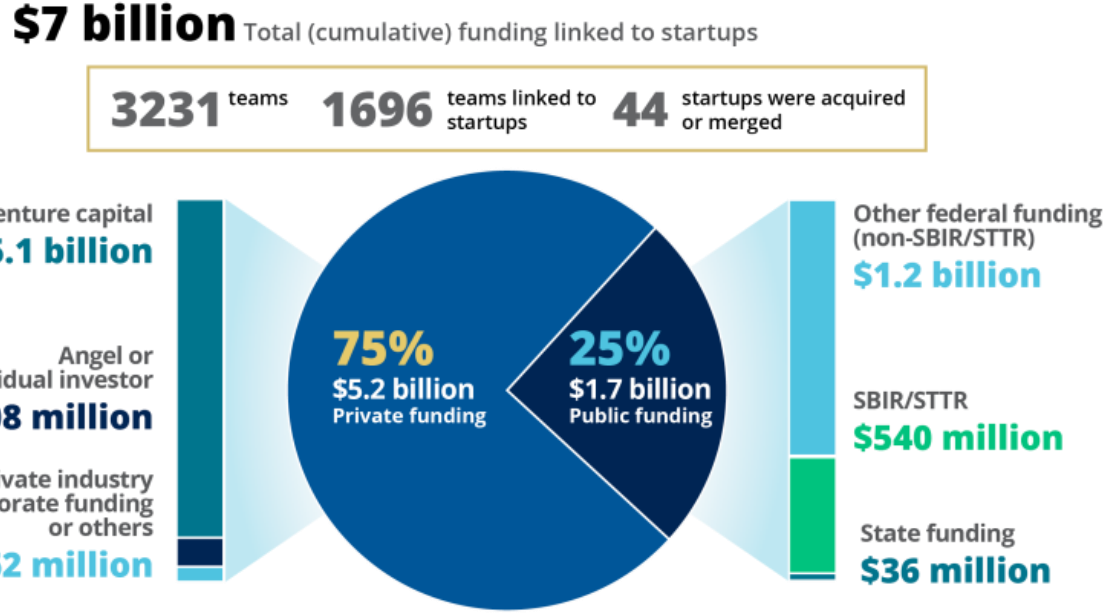
The mission of I-Corps is to reduce the risk associated with translating technologies from the laboratory to the marketplace. To do this, I-Corps uses experiential education to help researchers reduce the time it takes to translate promising ideas from the laboratory to widespread implementation.

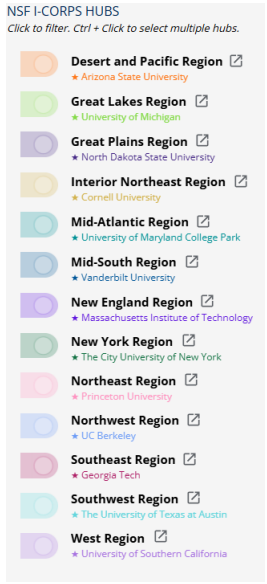
The **U.S. National Science Foundation Innovation Corps program** is an immersive, entrepreneurial training program that facilitates the transformation of invention to impact. I-Corps addresses four needs:

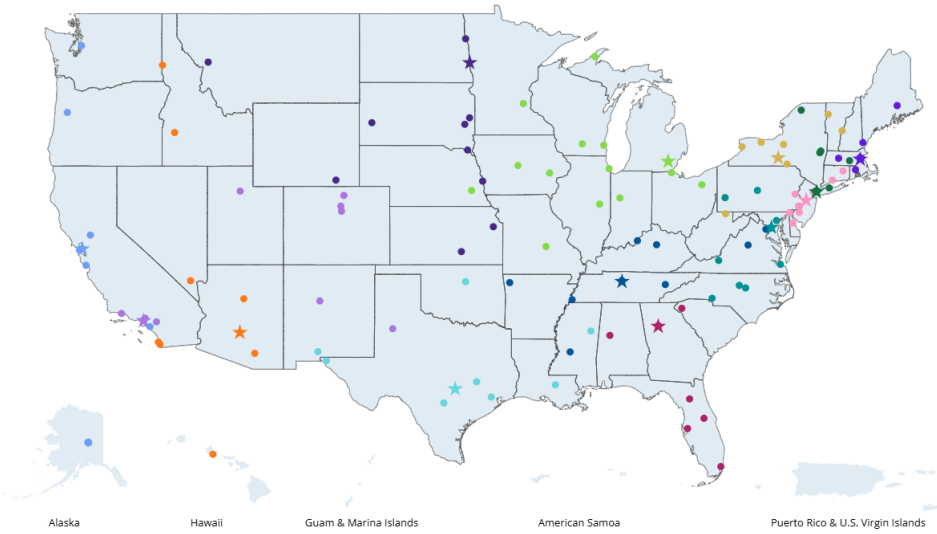
1. Training an entrepreneurial workforce
2. Translating technologies
3. Enabling positive economic impact
4. Nurturing an innovation ecosystem

NSF I-CORPS™ NSF Innovation Corps

https://www.nsf.gov/funding/initiatives/i-corps







Other Resources

Invention Convention Worldwide teaches students problem-identification, problem-solving, entrepreneurship and creativity skills and builds confidence in invention, innovation and entrepreneurship.

The K-12 invention education program convenes a community of educators, business leaders, parents and students through competitions, events and a flexible, project-based curriculum aligned to educational standards.

https://inhub.thehenryford.org/icw/home