

Looking at Patent Law: A Case Study Regarding the Patenting of a Plating Cell Invention

Part I – From Conception to Published Patent Application

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In this two-part article, we present a case study of an electrochemical plating cell invention. Part I of the case study begins with the initial concept as described in the Invention Disclosure and highlights key steps in the prosecution of the patent application by the U.S. Patent & Trademark Office (USPTO).

Recall from our previous article,¹ the prosecution history of a patent application is publically available in the file wrapper on the USPTO Patent Application Information Retrieval (PAIR) system and is the basis for this case study.² We chose this invention as particularly illustrative of a diverse number of prosecution “events” an inventor may encounter during the prosecution of their inventions. Table I summarizes this journey from the initial documentation and filing of the invention, through various interactions with the USPTO, to the issue of four separate but related patents. As noted in the legend of Table I, we use four different colors to highlight the events related to the four patents which issued from the single patent application. The following events that will be described in this case study occurred in chronological order:

- Creation of an Internal Invention Disclosure
- Inclusion of Patent Drawings in the Invention Disclosure to better describe the invention
- Establishment and Maintenance of a Filing Date
- Submission of an Information Disclosure Statement and Duty of Candor
- Acknowledgement of Federal Funding Sources
- Notice of the 18th Month Publication Requirement
- Restriction/Election Requirement Leading to Divisional Patent Applications
- Submission of Continuation-in-Part Applications based on ongoing research activities, and types of continuing applications
- Request for Continued Examination of Original Application with Affidavits
- Submission of Divisional Applications

The Patenting Process Starts with an Internal Invention Disclosure

Documenting the invention begins with the submission of an Invention Disclosure (ID) by the inventor(s) to the appropriate parties within their organization. Most organizations have their own specific ID, but generally included are:

1. Inventor Names
2. Working Title of the Invention
3. References related to the Invention (Notebooks, Reports, Proposals, Publications)
4. Funding sources if appropriate
5. Date of Public Disclosure or Anticipated Date of Public Disclosure
6. Problem-Solution Statement
7. Detailed Description of the Invention

As previously discussed, the “named inventors” must be correctly represented on a U.S. patent.³ Specifically, *inclusion* of a colleague as a co-inventor who did not participate in the conception of the invention is known as a *misjoinder* and invalidates an otherwise valid patent. Similarly, *exclusion* of a co-inventor who participated in the conception is known as a *nonjoinder* and also invalidates an otherwise valid patent.

The “working title” of the invention initiates the disclosure of the invention to the appropriate parties within the inventor’s organization. The “references related” to the invention provide documentation regarding the known prior art. The identification of the “funding

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sources” are important to document contractual obligations and in the case of government funding to acknowledge government “march-in rights” to the subject invention.⁴

Table I. Timeline of steps in the subject case study.

Internal Invention Disclosure
Mar 19, 2004: Application filed
Jun 3, 2004: Notice to File Missing Parts
Jul 26, 2004: Submitted Information Disclosure Statement
Apr 4, 2005: Acknowledged federally sponsored research
Sep 25, 2005: Application published
Dec 1, 2006: USPTO required Restriction/Election
Elected Appl. 10/804,841: Apparatus
Elected Div. Appl. 12/431/030: Process
Mar 23, 2007: Non-Final Rejection
Jun 25, 2007: Examiner Phone Interview
Aug 10, 2007: Filed C-I-P Application
Sep 21, 2007: Final Rejection
Jan 22, 2008: Request for Continued Examination
Aug 10, 2007: Filed C-I-P Application
Apr 2, 2008: Non-Final Rejection
Sep 30, 2008: Submitted Affidavit
Jan 8, 2009: Final Rejection
Feb 20, 2009: Amended Claims
Mar 16, 2009: Notice of Allowance
Apr 28, 2009: Application Filed
May 21, 2009: Paid Issue Fee
Jun 30, 2009: 7,553,401 Patent Issued
Aug 20, 2009: Application Published
Sept 10, 2010: Non-Final Rejection & Restriction/Election
Elected C-I-P Appl. 11/836/903 Apparatus
Elected Div. Appl. 13/086,683: Process
Apr 14, 2011: Application Filed
Sep 11, 2011: Application Published
May 24, 2011: 7,947,161 Patent Issued
Jul 24, 2012: 8,226,804 Patent Issued
Dec 11, 2012: 8,329,006 Patent Issued

Legend	
Patent Application 10/804,841: Apparatus	
Continuation-in-Part Application 11/836,903: Apparatus	
Divisional Patent Application from 10/804,841: 12/431/030: Process	
Divisional Patent Application from C-I-P Application 11/836,903: 13/086,683: Process	

Prior to the Leahy-Smith America Invents Act of 2011 (AIA), the U.S. awarded a patent to the “first-to-conceive” the subject invention. In these cases, witnessed notebook references were critical to document the inventors’ contribution to the conception of the invention and the date of the invention. After the AIA, the U.S. patent system is in harmony with most of the world and awards the patent to the “first-to-file” the subject invention. The witnessed notebook references are still important to document those contributing to the conception of the invention, but are no longer relevant to establishing the “first-to-conceive” the subject invention. The first-to-file component of the AIA applies to patent applications filed on or after March 16, 2013.⁵

The “date of public disclosure” or “anticipated date of public disclosure” is important in that the inventor has one year from public disclosure to file a patent application in the U.S.⁶ In essence, the U.S. could be considered as a “first-to-publicly-disclose” patent jurisdiction. This one year grace period from public disclosure does not apply to most foreign jurisdictions as the ability to file a foreign patent is barred by public disclosure.

As previously noted, the “problem-solution” statement is a convenient way of forcing the inventor to concisely state the significance of their concept in view of the prior art:⁷

“The problem(s) of ... is (are) solved by ...”

The “problem-solution” statement forces the inventors to reduce their invention to this one, albeit long, statement. As a consequence, the elements of the invention are succinctly and broadly stated. The “problem-solution” statement and the “detailed description” of the invention become the basis of the claims and interaction with patent counsel.⁸

In our case study Invention Disclosure, the inventors of the subject electroplating cell disclosed the following “problem-solution” statement:

The problem of ...

non-uniform electrodeposition of a metal such as copper on an approximately planar workpiece such as a printed circuit board wherein the plating electrolyte is agitated using air sparging and/or educator directed solution flow in a perpendicular or angular orientation against the workpiece is solved by ...

positioning eductors below the workpiece and directing the electrolyte flow against a dampening element which guides the solution across the workpiece through a channel formed by the workpiece and a cloth between the workpiece and the counter electrodes resulting in uniform electrodeposition of a metal such as copper on the workpiece.

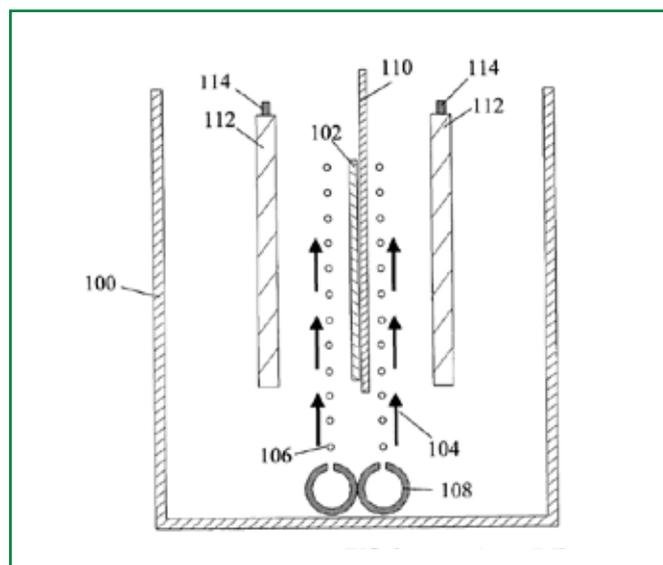


FIG. 1. Illustration of electrolyte agitation using air sparging.

While the “problem-solution” statement is somewhat clumsy in terms of writing style, our experience is that it forces the inventor to concisely and precisely describe their invention and distinguish it from the prior art. This provides a “jump-start” for patent counsel as they review the detailed description and begin to draft the independent claims.

After careful drafting of the “problem-solution” statement, we began drafting of the “detailed description” of the invention that we briefly describe herein. A detailed description of the subject electroplating cell technology being discussed in this case study is contained in a recent publication.⁹

Use of Patent Drawings in the Invention Disclosure

We begin our drafting process with creation of the figures, as we generally believe it is valuable to illustrate the prior art to distinguish our invention. So as to facilitate better communication of the nature of the invention between Faraday Technology, Inc. and the patent attorney, Faraday scientists and engineers have been trained in the basic mechanics of patent drawings illustrating the key elements of the invention.¹⁰

In Fig. 1 and 2, we illustrate the prior art electrolyte agitation using air sparging and eductors, respectively. Notice how the drawings are derived from the “problem” component of the “problem-solution” statement. Further note that the drawings distinctly point out the key elements in the prior art drawings using a numbering system. We find it helpful, although not required, to include a glossary of the key elements (Table II) in the “detailed description” of the invention. In Fig. 3 and 4, we illustrate the non-uniform boundary layer resulting from educator directed solution flow impinging the workpiece perpendicularly and angularly, respectively. We disclosed the experimental results within the “detailed description” illustrating the non-uniformity of an electrodeposited metal foil plated onto a planar workpiece using the prior art approaches.

In Fig. 5, we illustrate the key elements of our invention wherein the eductors are positioned below the workpiece and the electrolyte flow is directed against a dampening element that guides the solution across the workpiece. Notice how the drawing is derived from the “solution” component of the “problem-solution” statement. The key elements in Fig. 5 are depicted in red and include:

1. Variable high velocity educator agitation (116);
2. Shaped guides to direct educator flow across the cathode (136);
3. Use of anode chamber (126) with porous polymeric cloth (128) creating a channel for electrolyte flow;
4. Baffles beneath anode chamber to isolate educator flow to cathode (138);

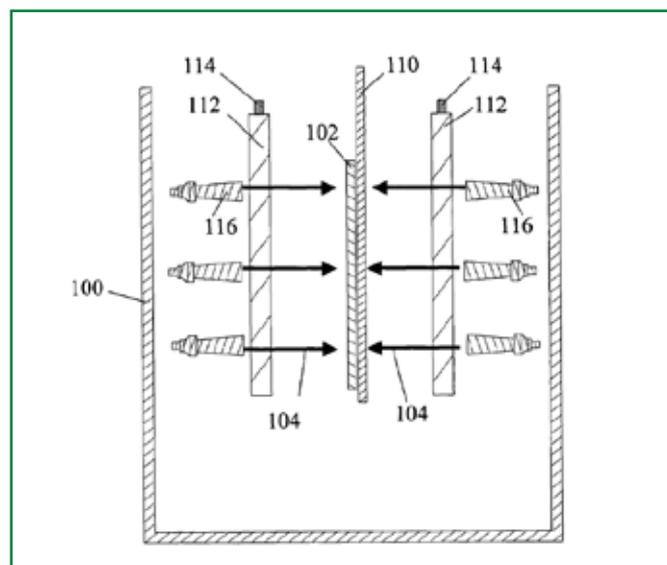


Fig. 2. Illustration of electrolyte agitation using impinging eductors.

5. Non-conductive shielding to eliminate edge effects (130); and
6. Lateral oscillation (154) and vibration (152) to help facilitate solution flow into board features.

These key elements were referred to in the claims of the patent application. In addition, the patent application included two statutory classes of invention, apparatus and process.⁸

Establishment of a Filing Date

The patent application was filed March 19, 2004 in accordance with U.S. patent laws. Specifically, in order to *establish* a filing date, we submitted a patent application including:

1. Specification¹¹
“A written description of the invention, and the manner and process for making it ... to enable any person skilled in the art ... to make and use [the invention]”
2. A Minimum of one claim¹²
“Particularly pointing out ... the subject matter ... as the invention”
3. Drawings¹³
“Where necessary for understanding the subject matter ... to be patented”

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Table II. Glossary of key terms.

100. Plating cell
102. Workpiece
104. Arrow indicating electrolyte flow
106. Air bubbles
108. Pipe
110. Rack
112. Anode
114. Rail
116. Eductor
118. Impingement point
120. Fluid flow profile
122. Jet centerline
124. Velocity profile
126. Anode chamber
128. Porous fiber cloth
130. Non-conducting shielding
132. Pump
134. Manifold
136. Guide
138. Baffle
140. Arrow indicating electrolyte flow
142. Arrow indicating electrolyte flow
144. Hole
146. Baffle
148. Side chamber
150. Outlet hole
152. Arrow indicating vertical vibration
154. Arrow indicating oscillation

On June 3, 2004, correspondence from the USPTO assigned patent application number 10/804,841 to the invention. In addition, our attorney of record received a “Notice to File Missing Parts of an Application” from the USPTO with a two month response date. In order to *maintain* the filing date, the following additional material is required:

1. Filing fee in accordance with the current USPTO schedule¹⁴
2. Inventor oath or declaration asserting¹⁵
 - a. The patent application was authorized by the inventor(s),
 - b. The inventor(s) believe he/she is the original inventor or they are the original joint inventors.

We paid the filing fee and submitted a declaration within the two month period. The declaration must be notarized and per the Code of Federal Regulations (CFR):¹⁶

“False statements are punishable by fine or imprisonment ... and may jeopardize the validity of ... any patent application issuing thereon.”

Submission of an Information Disclosure Statement and Duty of Candor

On July 26, 2004, we submitted an “Information Disclosure Statement” (IDS) in accordance with U.S. patent laws. The IDS is the submission of relevant background art or information to the USPTO by the applicant. The “Duty of Candor” requires that the inventor submit an IDS within a reasonable time of submission of the patent application or at least prior to the first office action:¹⁷

“Disclose to the Office [USPTO] all information known to that individual to be material to patentability.”

The “Duty of Candor” is specific to any existing claim and requires that the IDS be continually updated while the claim is pending. The “Duty of Candor” ceases only when the claim is allowed and the issue fee is paid.

The “Duty of Candor” extends to any individual *associated* with the filing of the patent application including: 1) Inventor(s); 2) Patent Counsel; or 3) those persons who are substantially involved in the preparation or prosecution of the patent application. Substantial involvement could include technical assistants, collaborators or colleagues. Substantial involvement would generally not extend to clerical workers. Furthermore, the inclusion of a reference in an IDS:¹⁸

“Is not taken as an admission that the reference is prior art against the claims.”

If a finding of a violation of the “Duty of Candor” resulting in “inequitable conduct” regarding any claim in a patent application or patent is determined, then all the claims are rendered invalid.¹⁹ Finally, in spite of the requirement of the “Duty of Candor”, the applicant is cautioned not to “bury” the examiner with a long list of non-material references in hopes that the examiner will not notice the material references.

Acknowledgement of Federal Funding Sources

On April 4, 2005, we submitted an amendment to acknowledge federally sponsored research in accordance with the Bayh-Dole Act.²⁰ As a consequence, any patents issuing from the 10/804,841 patent application will have the government rights acknowledgement:

“The experimental work leading to this invention was funded in part by the Department of Defense SBIR Contract No. DASG60-01-C-0056.”

Notice of the 18th Month Publication Requirement

On September 25, 2005, the 10/804,841 patent application was published eighteen months from the earliest filing date in accordance with U.S. patent laws.²¹ The significance of the date of publication is that if the patent application eventually issues with a claim or claims that are substantially the same as in the published patent application, then the applicant may be able to collect reasonable royalties from any person who:²²

“During the period beginning on the date of publication ... and ending on the date the patent is issued makes, uses, offers for sell, or sells ... [and] had actual notice of the published patent application.”

Note, the person using the invention must be notified of the pending patent application.

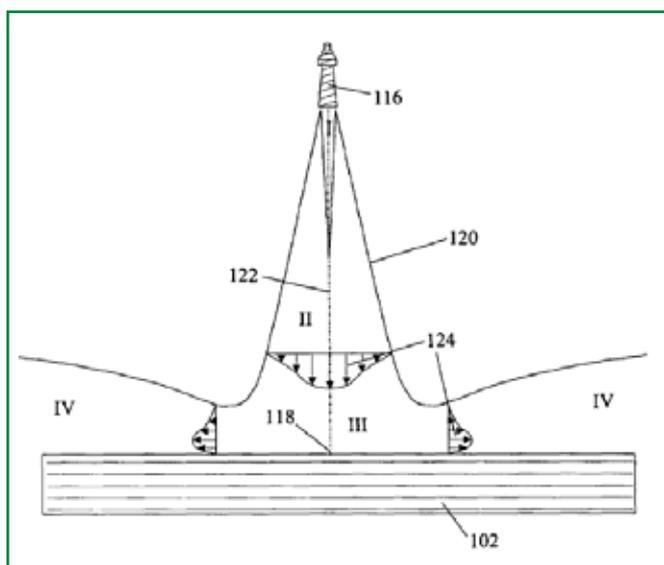


Fig. 3. Illustration of perpendicular impinging eductor electrolyte flow.

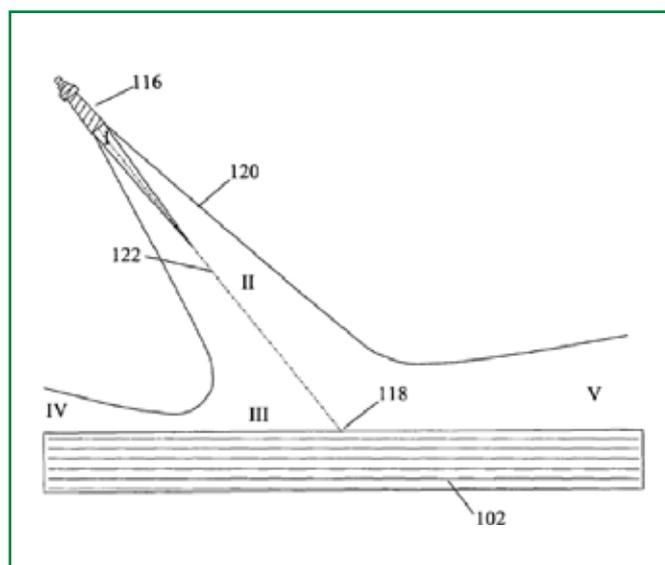


Fig. 4. Illustration of angular impinging eductor electrolyte flow.

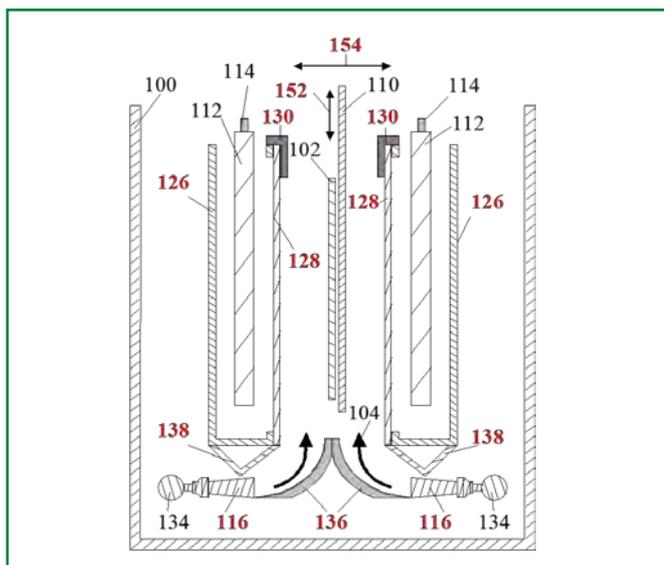


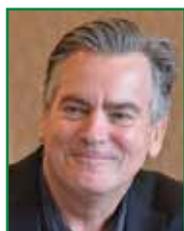
FIG. 5. Illustration of the subject plating cell invention.

Concluding Remarks

In this Part I installment of our “Looking at Patent Law” series, we presented a case study of the conception and preparation of a patent application related to an electrochemical plating cell invention. The case study begins with an “Invention Disclosure” (ID) including the basic items required therein including: 1) inventors; 2) title; 3) references; 4) funding source; 5) public disclosure if any; 6) problem-solution statement; and 7) detailed description. We particularly illustrated the value of the problem-solution statement with regards to drafting the patent drawings, detailed description and claims of the invention. We provided examples of patent drawings and their effectiveness in distinguishing the subject invention vis-à-vis the prior art. We described the patent application submission requirements to establish a filing date and the additional submission requirements to maintain the filing date. We introduced the requirement for an “Information Disclosure Statement” (IDS) and the associated “Duty of Candor” in interacting with the USPTO. We touched on the requirement to acknowledge federal funding sources. We discussed the eighteen month publication requirement of patent applications. Part II will continue with the office actions and responses that eventually resulted in the issuance of four U.S. patents. ■

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About the Authors



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